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Cash incentives to mothers or to community health workers - what contributes better to the health of the mother and the newborn? Evidence from India

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ABSTRACT

This paper investigates the role of demand-side incentives to mothers and supply-side incentives to community health workers (ASHAs) in improving maternal and child health. These conditional cash benefits were part of a nationwide health intervention *Janani Suraksha Yojana*, introduced in India in 2005. By its unique dual focus on demand and supply, the programme entitled socio-economically backward mothers with cash assistance if they chose to give birth at public health institutions, and simultaneously employed ASHAs to act as a direct link between a pregnant woman and the public health delivery system. By using variations across eligibility of mothers, and the differential implementation of ASHAs across low-focus and high-focus states in a difference-in-difference framework, the maternal and neonatal health outcomes are evaluated. Results show causal evidence that eligible mothers who received both cash benefits and ASHA's guidance outperformed the eligible mothers receiving only cash benefits, in outcomes such as institutional births and breastfeeding practices. To elucidate, a mother with both cash benefits and ASHA's counsel experienced a 7.1 percentage points increase in institutional birth rate than her ineligible counterpart; whereas, the corresponding increase for a mother only eligible for cash benefits was 2.9 percentage points. A similar impact is found in the case of antenatal care check-ups of the expecting mother and BCG vaccination of the newborn.

JEL Classification: I10, I38

Keywords: Conditional Cash Transfer, maternal health, child health, difference-in-difference, coarsened exact matching

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1. Introduction

Conditional Cash Transfer (CCT) programme is one of the proven methods for increasing human capital investment by resource-constrained households in low-income countries. In addition to short-term poverty reduction through income transfer, it is designed to serve as a powerful incentive for households in adopting a behaviour that could positively affect their well-being and break the cycle of poverty in the long run. Latin American countries were the first ones to experiment with this poverty-reduction tool in the early '90s in order to improve health and educational outcomes, and they showed positive results. *PROGRESA* (later named *Oportunidades*) in Mexico, *Bolsa Família* in Brazil are the major CCTs in the world, that have impacted lives of millions of beneficiaries till date (Fiszbein et al., 2009). As these examples suggest, CCTs are essentially targeted to address the demand-side problems of inadequate investment in human capital and/or uptake of health and education-promoting services. However, in many of these socio-economic settings of our interest, problems could be at the supply end (too), eg., the mediocrity of the service delivery system. For example, in several African countries, where the health service delivery system suffers from a severe lack of organisation and management (WHO, 2007), CCTs to low-income families would not be optimal at all. Under such circumstances, a CCT with only demand-side incentives is not only likely to leave behind mixed outcomes but also bigger unanswered questions such as, is the underutilisation triggered by lack of demand or lack of supply? The *Janani Suraksha Yojana* (“Safe Motherhood Programme”) in India is a healthcare policy which by its unique features helps investigate such an unanswered question. This CCT incentivised both the mothers as well as community health workers for improving maternal and neonatal health outcomes. By this unique dual focus, the programme brings forth the possibility to examine both the demand and the supply-side issues. By exploiting several intricacies of the programme’s features, this paper tries to uncover which is a more effective way to improve the health outcomes of the mother and the newborn - the demand-side incentives or the supply-side ones, or are they complementary to each other?

The Janani Suraksha Yojana (henceforth, JSY) programme started in April 2005 as an initiative of the Ministry of Health and Family Welfare in India and is still ongoing; the number of beneficiaries of the scheme increased from 0.738 million in 2005-06 to 10.438 million in 2014-15, with about 0.9 million health workers involved. As of 2010, it had a budget of 15 billion INR (1 USD \equiv 46 INR in 2010). Fifteen years later, in 2020, with the introduction of parallel schemes and with the redistribution of budgets, JSY now has 4.28 million beneficiaries and works parallel to another nationwide maternity benefit scheme, the *Pradhan Mantri Matru Vandana Yojana*.

JSY scheme divided the states as the high-focus and non-high focus ones, officially termed as the low-performing states (LPS) and high-performing states (HPS), and the cash incentives were to vary according to that categorisation.¹ In both the LPS and HPS, pregnant women above 19 years of age belonging to

¹The LPS were Uttar Pradesh, Uttaranchal, Bihar, Jharkhand, Madhya Pradesh, Chattisgarh, Assam, Rajasthan, Orissa and Jammu and Kashmir, where institutional delivery rates were alarmingly low (less than 25%) compared to the HPS which comprised of the remaining states.

below-poverty-line families and giving birth in public health centres were eligible for cash assistance for up to two live births. On the other hand, incentives were offered to the village-based health workers, known as the *Accredited Social Health Activists* (ASHAs), who were to act as an immediate link between the local community and the public health system. The ASHA’s basic duties regarding maternal and child health were to identify pregnant women in the community, to facilitate prenatal care for these pregnant women, to escort them 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. However, as the focus of the programme lay on the LPS, the ASHAs were introduced only there during the initial few years. The aim of this paper is to use the absence of the ASHAs in the HPS in the early years, along with the eligibility criteria of the mothers for the cash assistance, to distinguish the effects of the two channels on relevant health outcomes of the mother and the newborn.²

Using data from the second, third and fourth cross-sectional waves of the District Level Household Survey, I analyse a sample of more than 300,000 mothers with their most recent births in the time frame of 2001-2008. In a difference-in-difference (DiD) strategy framework, I use multiple treatment groups categorising “eligible mothers in low-performing states with ASHA” and “eligible mothers in high-performing states without ASHA”, and compare them with a control group of “mothers ineligible for any benefit”. I find that the mothers receiving both the cash benefits and ASHA’s counselling outperformed the mothers with only cash benefits in giving birth at public health facilities and in starting to breastfeed within 1-2 hours of birth. To put the difference in perspective, the eligible mother in the high-performing state experienced 2.9 percentage points (pp.) greater increase in institutional births³ than the ineligible mother. In contrast, for an eligible mother in a low-performing state, this increase in the difference with the ineligible mother was by 7.1 pp. These are equivalent to changes of about 11% and 27% in institutional birth rates compared to what an ineligible mother experienced in the pre-intervention period. Similar impact also found for antenatal care and BCG vaccination for the child. For the rural mothers with up to two births, the ASHA’s channel is distinctly more effective for all outcomes. However, the overall implication is that only receiving cash benefits for giving birth at public health facilities might not be sufficient for a mother to get motivated or overcome the costs. Continual guidance pre and post-birth by the health worker would lead to better all-round health of the mother and the newborn. An additional robustness analysis with the eligible mothers only in the HPS, who also received the ASHA’s guidance post-2008, highlights a similar superior effect of the ASHA in antenatal and birth outcomes.

Previous studies on JSY have mainly concentrated on the overall impact evaluation of the programme, i.e. its uptake and impact on reproductive and child health outcomes. The earliest of the studies is by Lim et al. (2010), who find that the intervention reduced perinatal and neonatal deaths and that the poorest and

²Note, however, that the effects studied here are *intent-to-treat* effects since the analysis considers the eligibility of the mothers and the availability of the ASHAs as per the guidelines of the programme regardless of whether an eligible mother actually got the cash transfer or an ASHA actually counselled her in a low-performing state.

³By ‘institutional birth’, I mean birth at a public healthcare facility which has been approved by the JSY programme.

the least educated women in the LPS were not the most probable ones to receive the cash assistance. Powell-Jackson et al. (2015), by exploiting the heterogeneous intensity in the implementation of the programme across districts, find evidence of increased uptake of maternity services by women due to cash incentives, but no substantial evidence on reduction in neonatal mortality.

Contrary to Lim et al.'s findings, Powell-Jackson et al. find that women of low socio-economic status utilised the programme more. Similar results are reported by Carvalho et al. (2014) with regards to immunisation rates, postpartum check-up rates, and healthy breastfeeding practices. By exploiting differences due to treatment eligibility of the programme in a sample of over 400,000 women, Joshi & Sivaram (2014) find moderate effects of the programme. They find that compared to the broader population, the targeted population experienced only three percentage points increase in medically supervised births; however, no increase in antenatal or postnatal care was found. Randive et al. (2014) analyse only the LPS by using a combination of surveys to see the change in socio-economic inequality in institutional deliveries after the implementation. They use concentration curve and concentration index and further decompose the index to understand channels of the inequalities.

Despite this substantial evidence on JSY on the whole, the related literature still lacks a more in-depth examination of which side of the financing has been more effective. It is where this paper's contribution lies. Although the nature of the programme allows for only a short-run analysis of this research question (due to the features becoming more or less uniform across all states over the years and also later getting combined with other state-level programmes), this study is able to explore the different channels sufficiently and provide some insights into how efficiently they can improve maternal and child health status in developing countries.

Another recent study by Debnath (2018) also focusses on the channels. While I consider the treatment variations through the mother's eligibility criteria for cash assistance and the availability of ASHA, Debnath exploits the variation in the amount of cash given as incentives to the ASHA and the eligible mothers. He finds that larger cash incentives to the health workers are associated with relatively high utilisation rates of these services compared to larger incentives to mothers. His further findings show an increase in the use of pre and postnatal healthcare services and a reduction in early neonatal deaths. However, Debnath's study does not take into account that the ASHAs were unavailable in the HPS until 2008, and also omits the revisions made in the JSY guideline on the eligibility of mothers in late 2006. Furthermore, the fact that the ASHAs in the rural areas received additional compensation to arrange for transportation of the expecting mother to the healthcare facility, while her own cash incentives remained the same as in the urban areas, has not been clearly discussed by Debnath; hence, the inference from the estimated effect of the ASHA's monetary incentives might suffer from some bias. My study offers an improvement over any such estimation bias by incorporating all relevant programme details.

Furthermore, my paper acknowledges the indispensability of public/community health workers in the improvement of health outcomes. They act as knowledge-base on health and sanitation practices and child-care to the women in developing countries (Block, 2007; Hirvonen et al., 2017). Also, incentive programmes

to public healthcare providers have proved to be effective in the use and service quality of healthcare, e.g. better performance of public health agents in promoting HIV prevention in Zambia (Ashraf et al., 2014), decrease in absenteeism of nurses in India (Banerjee et al., 2008). One paper worth mentioning here is by Basinga et al. (2011) which provides evidence that a randomised trial with performance-based pay to health workers increased institutional deliveries by 23% and receipt of postnatal care by newborns by over 50% in Rwanda. My paper lies at the junction of these two strands of literature - one, on the effectiveness of health workers as a knowledge source, and two, on the improvement of the service delivery by them through incentives.

In the literature on CCTs, the ones focused on various health aspects have shown improvement in preventive healthcare and healthy behaviour, such as vaccination coverage for children in rural Nicaragua (Barham & Maluccio, 2009), cervical cancer screening, annual HIV tests in low and middle-income countries (Ranganathan & Lagarde, 2012), and also nutritional outcomes in Mexican children (Behram & Hoddinott, 2005; Fernald et al., 2008b) and adults (Fernald et al., 2008a). In this vein, my paper contributes to the literature on health-based CCTs in terms of maternal and neonatal health outcomes. Also, this paper contributes to the literature in welfare programme impact evaluation which investigates the complementarity between supply and demand-side nudges and incentives. In other studies, Banerjee et al. (2010) have examined the impact on child immunisation by setting up immunisation camps in rural India vs providing food incentives to parents besides setting up camps, and Singh (2015) has examined the effect on children’s nutritional outcomes by incentivising the health worker through performance-based pay vs providing information to mothers besides worker incentives. Furthermore, to my knowledge, in the literature on JSY evaluation using the District Level Household Survey, this is the first paper that incorporates the latest available fourth survey round in order to investigate the programme impact in the high-performing states after the ASHAs were introduced there post-2008. Finally, this paper adds to the growing number of empirical studies that incorporate coarsened exact matching technique along with difference-in-difference in their methodologies, e.g. (Rellstab et al., 2020; Bertoni et al., 2020).

The remainder of the paper is structured as follows. Section 2 sketches the organisational background and the details of the CCT programme. Section 3 suggests the mechanisms. In Section 4, I introduce the data and empirical strategy for the analysis, followed by the main results in Section 5. In Section 6, I discuss some robustness issues and finally, in Section 7, I conclude.

2. The Indian Context

2.1. Maternal and child health in India

In the early '90s India, maternal mortality ratio (MMR) per 100,000 live births was 556 which accounted for almost 19.7% of deaths of women in their reproductive age due to issues related to pregnancy (in absolute terms, this number was as high as 152,000 maternal deaths). In addition to this, the neonatal mortality

ratio (NMR) per 1000 live births was 57.4. A decade later, MMR had reduced to 374, which was equivalent to 13% of women's deaths due to maternity, and NMR was still 45.1.⁴

This severity in the mortality rates often results from the missed utilisation of several necessary steps during maternity. Giving birth under the skilled supervision of health professionals is of utmost importance to necessitate the safety of the mother and the child. However, between 2001-04, only 7.4% of Indian women gave birth in the presence of any trained professional, and almost 3% did not give birth at a health facility due to lack of transportation. When it comes to the antenatal phase, it is prescribed that an expecting mother should receive at least three antenatal care (ANC) check-ups during the pregnancy to track her own and the child's health. These check-ups encompass an examination of weight, blood pressure, abdomen, ultra-sound tests of the pregnant woman and can be done in any health-centre, clinic or hospital. (If it would be a public one, then it would be available for free.) Together with the check-ups, the expecting mother also receives advice on breastfeeding, need for cleanliness during delivery, family planning and nutrition for herself and the child. During these check-ups, she is also given Iron Folic Acid tablets/syrups and Tetanus injections.⁵ However, my pre-intervention sample shows that only 48.5% expecting mothers received the recommended three ANCs.

Over the past decades, continued evidence on the positive effect of breastfeeding on child health, particularly in developing nations (Attanasio, 2015), has led to the conclusion that early breastfeeding by the mother reduces chances of child mortality. WHO recommends new mothers to start breastfeeding already at the first hour of birth, followed by exclusive and continued breastfeeding until the first six months of birth. However, the pre-intervention sample shows that only 27.2% were breastfed at birth. Finally, it comes to postnatal care of the mother and the child. My data shows that only 10% of the new mothers between 2001-04 received any postnatal visit by a health worker within two weeks of giving birth. Administering vaccines in the early months is crucial to the child's well-being at a later age. When looking at the receipt of the BCG vaccine⁶, we see that only 68% of newborns were vaccinated, even though it is recommended that BCG should be given to all newborns within two weeks of birth, as part of the National Immunisation Programme.⁷

⁴Source: WHO, UNICEF, UNFPA, World Bank Group, and United Nations Population Division Maternal Mortality Estimation Inter-Agency Group.

⁵According to WHO guidelines, daily oral iron and folic acid supplementation with 30 mg to 60 mg of elemental iron and 400 µg (0.4 mg) folic acid is recommended for pregnant women to prevent maternal anaemia, puerperal sepsis, low birth weight, and pre-term birth. WHO further recommends, a pregnant mother should receive two doses of tetanus-toxoid containing vaccine. Neonatal infection usually occurs through the exposure of the unhealed umbilical cord stump to tetanus spores, which are universally present in the soil, and newborns need to have received maternal antibodies via the placenta to be protected at birth.

⁶Tuberculosis (TB) has been a significant public health problem all over the world and was recognised as a global emergency by WHO in 1993. In 1995, out of the total TB cases in the world, the South-East Asia region accounted for 42% of the cases. The highest number of TB patients were found in the Indian sub-continent, with estimated incidence rates of more than 100 per million population (WHO, 1997). The *bacille Calmette-Guérin*, most commonly known as BCG vaccine, has existed for over 80 years and has a documented protective effect against tubercular meningitis and disseminated TB in children. Thus, the BCG vaccine is included as a part of the national childhood immunisation programme in almost all countries, including India.

⁷The discussed statistics related to the births in pre-intervention years are obtained from author's calculations using DLHS 2 and 3.

For these inferior outcomes on maternal and child health, both the demand and the supply ends are partially responsible. Although the public healthcare system in India allows for free and low-cost maternal and child healthcare, the uptake of those services remains relatively low (and often, only constricted to mothers of upper socio-economic background, urban residence and sometimes, certain religions). The major contributing factors of this underutilisation of maternal and child healthcare are high indirect costs, the practice of informal payments, socio-cultural norms, gender inequality and broadly prevalent economic inequality. Gender inequality, together with traditional patriarchal norms and practices in society, often deprives women of their rights of accessing basic healthcare (Drèze & Sen, 2002). At the same time, the quality of healthcare provision has not been cooperative either. A body of literature exploring various aspects of the healthcare system of India, confirms issues such as inadequacy of medical equipment in healthcare facilities and absenteeism of health professionals. Furthermore, the rate of usage of public healthcare has been found to be strongly correlated with absenteeism of health professionals from health facilities (Banerjee et al., 2004; Banerjee & Duflo, 2007).

2.2. The Janani Suraksha Yojana Programme

In order to address these demand and supply-related blockages leading to such a dire status of maternal and child health in the country, the Government of India introduced this nationwide intervention. The JSY programme, as a component of the *National Rural Health Mission*⁸, took off in April 2005. Its objective was to reduce maternal and neonatal mortality by promoting institutional delivery among poor pregnant women. The intervention was ambitious with a dual focus. It intended to increase the demand for (quality) maternal and neonatal healthcare by giving cash assistance to mothers for institutional delivery, and simultaneously, aimed to improve the healthcare service delivery to the poor by engaging ASHAs to serve as village-based health workers. The main thrust of the programme, however, lay on the low-performing states that were the worse performers in maternal and child health indicators compared to the high-performing states. (**Figure B.1 in Appendix B** shows the two categories of states.) The JSY programme is still ongoing and has been joined by other state-level similar schemes over the years.⁹

During its initial few years, the programme underwent a few rounds of revision. The first set of guideline took effect nationwide from April 2005. Soon after, it went through a revision in October 2006. It was

⁸The National Rural Health Mission, an initiative of the Ministry of Health and Family Welfare of India, aimed to provide equitable, affordable and quality health care to the rural population, especially the vulnerable groups. The mission focussed on establishing a fully functional, community-owned, decentralised health delivery system with inter-sectoral convergence at all levels, to ensure simultaneous action on a wide range of determinants of health such as water, sanitation, education, nutrition, social and gender equality.

⁹Note, before the introduction of JSY, another scheme *National Maternity Benefit Scheme* (NMBS) was introduced in 1995 as a component of a broader National Social Assistance Programme. This scheme gave the pregnant women who belonged to below-poverty-line households and had attained 19 years of age, the right to receive 500 INR of financial assistance per live birth for up to two live births. This scheme was uniformly prevalent across the entire country, unlike the JSY that introduced a graded scale of assistance based on the categorisation of states and residence status. NMBS was transferred from the Ministry of Rural Development to the Ministry of Health and Family Welfare during 2001-02. It is plausible that despite the presence of NMBS, the looming difference in the health outcomes of the mother and the newborn, across different states, led to the replacement of NMBS by JSY.

followed by further revisions, for example after 2008 (taking effect from April 2009), when the ASHAs spread to the HPS as well. Later in June 2011, with additional features on eliminating all out-of-pocket expenditures, the programme came to be known as the *Janani Shishu Suraksha Karyakram* (“Mother Safety Child Programme”). Another conditional benefit scheme at national-level, named the *Indira Gandhi Matritva Sahyog Yojana* was conceived in 2010 (and took effect from late 2011) and focussed on the compensation of wage loss of women during and after pregnancy.

2.2.1. Eligible mothers

According to the first set of guidelines¹⁰, which was published by the Ministry of Health and Family Welfare in April 2005, the cash incentives to mothers were to vary between the low-performing states and high-performing states (inclusive of the union territories).¹¹ In both the LPS and HPS, pregnant women above 19 years of age and belonging to below-poverty-line families,¹² giving birth in public healthcare facilities (such as primary health centres, community health centres, first referral units, general wards of district and state hospitals or accredited private institutions), were eligible for the cash assistance for up to two live births. However, the eligibility criteria in the LPS and HPS were different. The LPS being under extra attention, the women from both rural and urban areas in the LPS could avail the cash assistance, but, the women from only the rural areas in the HPS could do so.

However, this set of rules was soon criticised since it did not effectively encompass all the socio-economically backward women in the country among whom the institutional birth rates were the lowest. As a result, the eligibility criteria were made less restrictive. Consequently, from October 2006 onwards, all women in the LPS irrespective of their residence type, income level and birth history could avail the cash assistance if they chose to give birth in the public healthcare facilities. In the HPS, the previous eligibility also spread across the urban areas; and the women who belonged to socially disadvantaged castes like *Scheduled Caste* or *Scheduled Tribe* families also came under the coverage now.¹³

In the empirical analysis in Section 4.2, I consider the eligibilities of the mothers (in terms of their socio-economic indicators, residence type and birth history) for the cash assistance as per the first and second guidelines of the programme. Taking into account the revisions of the guidelines on the eligibility of the mothers, I consider the *first phase eligible mothers* who satisfied the eligibility criteria of the first guideline that took effect from April 2005, and the *second phase eligible mothers* who did not satisfy the eligibility criteria of the first guideline but of the second guideline that took effect from October 2006.

¹⁰downloaded from “www.ilo.org/dyn/travail/docs/683/JananiSurakshaYojanaGuidelines/MinistryofHealthandFamilyWelfare.pdf”

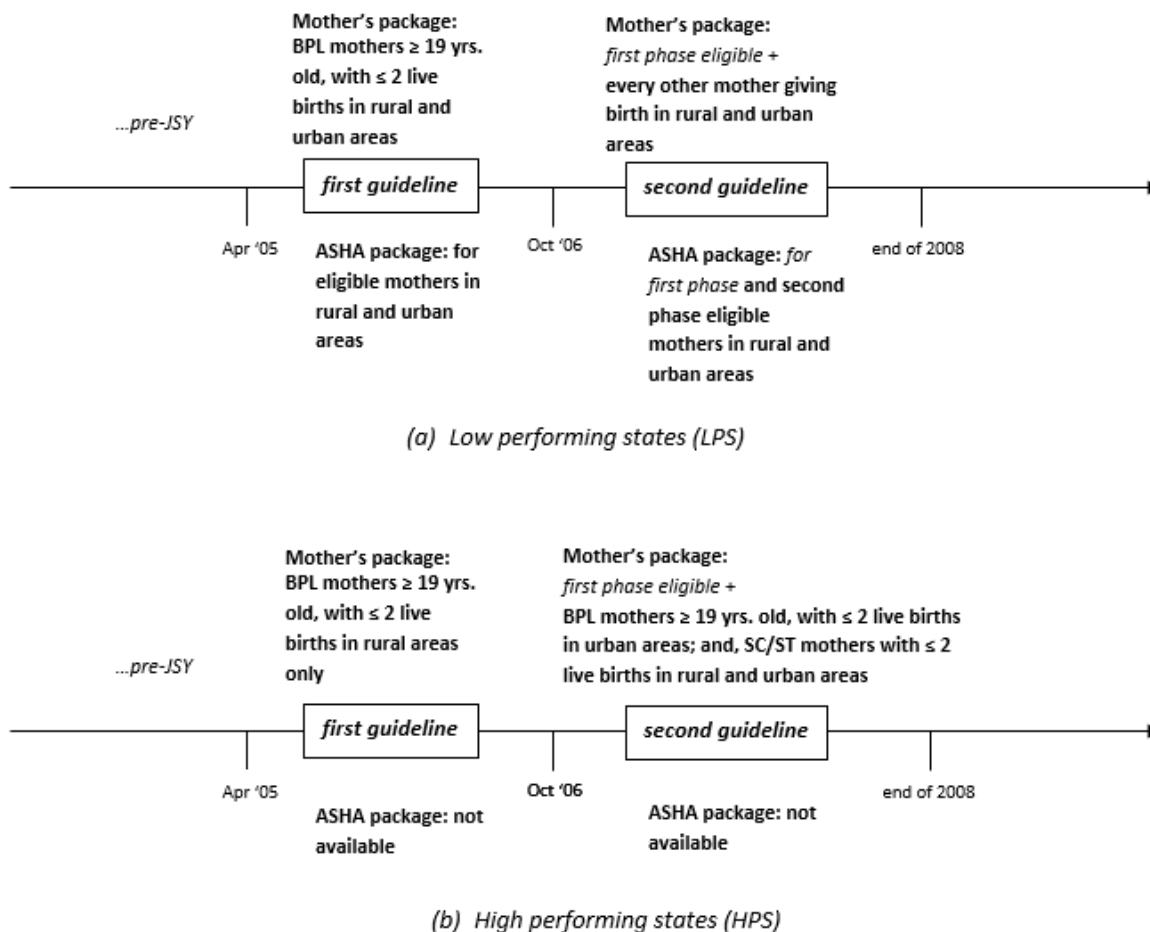
¹¹The union territories of India come directly under the administration of the Central Government whereas the states of the country have decentralized governments. The union territories of India during this study period were Andaman & Nicobar Islands, Chandigarh, Dadra & Nagar Haveli, Daman & Diu, Delhi, Lakshadweep and Puducherry.

¹²A below-poverty-line household is the one which has insufficient income to purchase two basic meals per day. This *poverty line* value differs across rural and urban areas and states. According to the Tendulkar Committee, the *poverty line* based on per capita consumption expenditure per day was 27 INR in rural areas and 33 INR in urban areas in 2009 (Tendulkar et al., 2009).

¹³downloaded from “<https://mohfw.gov.in/sites/default/files/FEATURES%20FREQUENTLY%20ASKED%20QUESTIONS.pdf>”

Figure 1 summarises the eligibility structures as given by the first two guidelines of the programme. Therefore, the time-period used in my main analysis is between April 2005 to the end of 2008.

Figure 1: JSY programme details - the first two guidelines



Notes: This is a simple representation of the eligibilities of the new mothers according to the first two guidelines for the mother's package and the ASHA's package. BPL is below-poverty-line, SC, ST are *Scheduled Caste* and *Scheduled Tribe* classes. For a more detailed guideline which also include the scale of monetary incentives, see **Appendix B Figure B.4**.

2.2.2. ASHAs

The village-based health workers called the ASHAs constituted an integral part of the JSY programme. The ASHAs were only employed in the LPS, according to the first two guidelines of JSY; later in 2009, the ASHAs spread across the HPS too.¹⁴

Typically, an ASHA was a female resident of a village, within the age group of 25-45 years, and with

¹⁴However, it is unclear from the official guidelines, if the ASHAs were employed in the union territories. Therefore, later in my analysis, I exclude the union territories.

primary 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, together with the presiding officers at the district and sub-district levels. The selected ASHAs were trained in basic health care practices. The ASHA's primary duties regarding maternal and child health were to identify a pregnant woman in the community, register her with the programme 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.¹⁵

Note that, as a treatment variation in the main estimation strategy in Section 4.2, I use the presence of ASHA in the LPS and her consequent absence in the HPS during the time-period when the first two guidelines were in effect.

2.2.3. Cash incentives and timings of payments

As treatment variations, this paper focusses on using the eligibility status of the mother for the cash assistance and the availability of ASHA at state-level. Nevertheless, in this section, I briefly outline how the cash incentives were designed and revised, and where lay the conditionality of the incentives.

The cash assistance to the pregnant woman, i.e. the 'mother's package' per live birth varied in scale across rural and urban areas. According to the first guideline, in the rural areas, the mother's package was 700 INR in both the LPS and HPS and 600 INR in the urban areas of the LPS. According to the second guideline, the cash amounts for the rural HPS remained the same with an addition of 600 INR mother's package in the urban HPS. Also, the amounts in the LPS were updated to 1400 INR and 1000 INR in the rural and urban areas. The monetary incentives in the LPS were quite substantial - around 63% of the poverty line expenditure cut-off, and 68% of the average delivery cost in a government medical facility (Tendulkar et al., 2009). The mother received the cash assistance at the time of discharge from the health facility after she had given birth.

The 'ASHA's package' per live birth, however, was only available in the LPS; 600 INR in rural areas and 200 INR in urban areas. Of this 600 INR, only 200 INR was her incentive for all her duties and the remaining was for organising transportation of the beneficiary to the nearest health centre for delivery and her own logistics support when she stayed with the expecting mother at the health facility for delivery. In the rural areas of LPS, the transportation and logistics compensation was to be paid to the ASHA in advance. But, her cash incentive came in instalments - the first one was paid during/after the discharge of the mother from the health facility, and the second, a month after delivery on confirming postnatal care visit and administering the BCG vaccine to the newborn. In the urban areas, only the incentive part of 200 INR

¹⁵Note that, apart from the JSY programme, the ASHAs were also involved in spreading awareness across households in the community regarding general health, family planning and sanitation needs.

was available to the ASHA since it was not mandatory for her to arrange for transportation for the mother nor stay with the mother at the health facility during labour.

3. Conceptual Framework

One of the most cited reasons among the poor women in India for not having institutional deliveries is the attached costs. Women living in remote villages would often require to travel long distances in order to avail proper healthcare; hence they choose to give birth at home or in the absence of skilled supervision. Besides the indirect costs due to transportation for the expecting mother in labour as well as other accompanying family members, another cost that usually arises is the opportunity cost of their lost wages of the days spent at the health facility due to birth. Under such circumstances, the cash assistance given to the mother (or the promise of it until she delivers the baby) through the programme, should ease the budget constraint of the household while choosing institutional births. Particularly for women in rural areas where these costs are relatively high, the cash incentives are likely to have a more substantial effect.

Another channel of lack of institutional births among socio-economically backward women is the dearth of right knowledge and information on hygiene and safety issues of giving birth. Most of these mothers are often unaware of the health risks involved with pregnancy. In that regard, the ASHAs are a positive addition to the JSY programme. The fact that the ASHA counsels and helps the expecting mother through every step of her pregnancy would lead to informed decision-making by the latter and thus reduce the chances of giving birth in unhealthy conditions.

Note that the mother's package was available in the high-performing states, and both the mother's package and ASHA's package were available in the low-performing states. One could expect to examine by comparing the eligible mothers in the HPS with the ineligible mothers whether the mother's cash incentive was effective in overcoming the indirect costs due to transportation and opportunity cost. Then by comparing the eligible mothers in the LPS with the ineligible mothers, it is possible to investigate if the dual incentives - one to the mother and the other to the ASHA, were useful to offset both the mother's indirect costs as well as the information gap. Now, by comparing the outcomes of the eligible mother in the LPS vs the HPS, it is possible to understand whether additional employment of the ASHA necessarily improved the outcomes. A positive difference would suggest that the information cost was a significant deterrent of the utilisation of maternal and neonatal services, and incentivising the health workers did provide an effective solution to that. On the other hand, if both the state-types faced similar improvements, with no added effect in the LPS, then it can be concluded that incentivising the mother to offset the indirect costs was enough and there was no information gap, in this context.

However, here it is crucial to recognise that eliciting the effect of the ASHA's channel merely by comparing the LPS and HPS mothers, who could be compositionally quite different, is not straightforward. Therefore, it would be worthwhile to compare a homogeneous sample across the two state-types in order to conclude on this better. When the LPS eligible mothers are demographically identical to those in the HPS, then it

is easy to pin down the added effect on the former precisely through the ASHA's presence (also, given that the mother's cash incentive was of the same amount in the two state-types). In the later sections, I address these issues.

On a related note, there is some rationale behind the outcome variables chosen here. The criteria for the programme benefits tell that the mother's incentive was only pivotal on her having institutional birth, and did not mandate her to go through antenatal care and postnatal care check-ups in order to receive the cash benefit. However, the ASHA's performance-based pay required her to complete a set of duties during the antenatal, birth and postnatal phase. So looking at those particular antenatal and postnatal outcomes could also provide a precise angle on the ASHA's channel of effect.

4. Data and Empirical strategy

4.1. Data

The District Level Household Survey (DLHS) is the most useful health-related data source at the district level in India. I use the second and third rounds of this repeated cross-sectional survey (henceforth, DLHS 2 and 3) to obtain information on births by mothers across all districts, before and after the implementation of the programme. The DLHS is administered by the Institute for International Population Studies (Mumbai, India) and its partner organisations. To date, they have implemented four rounds of the survey. The DLHS 2 has information on 507,622 married women sampled across the districts in 2002-04 and DLHS 3 has information on 643,944 married and unmarried women sampled during 2007-08. These two surveys contain detailed information on ANC, delivery (including details of receipt of JSY cash assistance) and PNC of the most recent birth by mothers during 1998-2004 and 2004-08 respectively. Additionally, the surveys contain information on the demographic composition and socio-economic characteristics of the household - including caste, religion, and wealth status.¹⁶

By merging DLHS 2 and 3, the sample for my analysis is comprised of every woman who is married and is of age 15-49 years and had her most recent birth between 2001-2008. It leaves a sample of a little over 300,000.¹⁷

In the analysis, I use the information on the mother's characteristics which are, her age while giving birth, her maximum schooling years, the total number of births she had in the past, 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, household wealth status (given in deciles of wealth distribution). All these information are directly available from the woman's questionnaire modules

¹⁶This survey is more relevant to the intervention's timeline than any another potential data source on India (e.g. the combination of India Human Development Surveys I and II), in the sense that the DLHS offers more number of observations with their delivery details, from the pre-intervention period.

¹⁷Although DLHS 2 has information on births from 1998-99, I restrict the sample from 2001 onward to have the *pre* and *post* windows equally distributed around the reform.

of DLHS 2 and 3. I formulate the wealth index by using *principal components analysis* with a variety of assets owned by the households.¹⁸

For further information on village health infrastructure, I use the information on the presence of early childhood development services such as the *Integrated Child Development Services*¹⁹ in the village. An indicator for this should control for whether the mother benefitted from any other welfare and early childcare related programmes. Furthermore, I control for distance to the nearest primary health centre, to the nearest community health centre and the nearest public district hospital. The information on these indicators is available from the village questionnaire module of the survey.

Among the binary outcome variables used are institutional births, at least three ANC's received by the mother, if the mother started breastfeeding within an hour or two of giving birth, and if the baby received BCG vaccine after birth. The choice of these outcome variables is driven by the fact that these are the immediate components which can be affected by the programme and can significantly contribute to the arresting of maternal and child morbidity and mortality over time, which is the main aim of the programme.

The institutional birth rate is the most vital outcome to look at in this context because this is what the programme wanted to impact the most. The binary variable on institutional birth is obtained from information in the woman's questionnaire on whether she had her latest birth at a public health facility.²⁰ It is recommended to have a standard number of three ANC's during pregnancy. As a measure of ANC received by the expecting mother, a dummy variable is used to indicate whether she received at least three ANC's. Then the binary variable on breastfeeding is denoted by the information on whether the mother breastfed the baby within 1-2 hours of birth. Finally, the information if the child received a BCG vaccine is obtained from the two waves of DLHS. Although the DLHS 3 data allows recognising precisely whether the child received the vaccine within a month of birth, the DLHS 2 does not. Therefore, I resort to using a more general variable that suggests only whether the child got vaccinated with BCG or not.

Lastly, for additional analysis on the introduction of ASHAs in the HPS (as discussed in Section 6.3), I combine the latest DLHS 4 wave undertaken in 2012-14, with DLHS 2 and 3. Here, I use similar information on mothers of age 15-49 years who had their latest birth from 2001 until May 2011, only in the high-performing states. The relevant sample contains over 145000 observations.

¹⁸Since DLHS 2 does not have direct information on the below-poverty-line status, I compute this wealth index and use the bottom-most quintile of the distribution to define the poor. Joshi & Sivaram (2014) use a similar methodology. Many different indices have been used to decide on the poverty line in India. As per India's Planning Commission figures of poverty between 2004-05, the rural and urban percentages below the poverty line were 22.7% and 21.9%. In that regard, defining the poor as the bottom-most quintile of wealth distribution is quite acceptable.

¹⁹Since 1975, the *Integrated Child Development Services* scheme is one of the flagship programmes undertaken by the Government of India, on early childhood care and development. The beneficiaries under this scheme are children in the age group of 0-6 years, pregnant women and lactating mothers. The offered health services are supplementary nutrition, health check-up, referral services and immunisation. They are usually provided by Auxiliary Nurse Midwives and *Anganwadi* workers (*Anganwadi* being a type of rural childcare centre in India). Other development services include pre-school and non-formal education.

²⁰A public health facility, approved by the JSY programme, covers public hospital, dispensary, primary health centre, community health centre, UHC/UHP/UFWC, AYUSH hospital/clinic.

4.2. Empirical strategy

The goal of this paper is to estimate the causal effect of the JSY programme, through its different channels, on the health outcomes of the mother and newborn. Given the roll-out of the programme, two major *phases* should be considered - one when the mother’s eligibility was determined according to the first guideline, and the other when the eligibility was determined by the second guideline. This is because, after the second guideline was introduced, the new eligibility status now encompassed more mothers who would otherwise be in the ‘control’ group should I only consider the first guideline’s eligibility.²¹ This essentially gives rise to two sets of eligible mothers along the timeline - the ones who became eligible according to the first guideline, and then the ones who were not eligible according to the first guideline, but became so after the second guideline took effect. Alongside them, remains a set of mothers who never became eligible.

Then comes the variation in the availability of the ASHA at the state-level. Throughout the period when the first and second guidelines were prevalent, ASHAs were available to counsel the eligible mothers only in the low-performing states and not in the high-performing states.

Taking into account the above variations, I have four treatment groups - “eligible mothers according to the first guideline without the presence of ASHA”, “eligible mothers according to the first guideline with the presence of ASHA”, “newly eligible mothers according to the second guideline without the presence of ASHA” and “newly eligible mothers according to the second guideline with the presence of ASHA”. The control group consists of those mothers who never become eligible for any assistance.

Therefore, to estimate the causal impact of the programme, I resort to a DiD specification. For a mother i giving birth in a state j in a year t , I estimate the following:

$$\begin{aligned}
Y_{ijt} = & \alpha + \beta_1 \text{EligiblewithoutASHA}_{ij} + \beta_2 \text{EligiblewithASHA}_{ij} \\
& + \beta_3 (\text{EligiblewithoutASHA}_{ij} * \text{Post1}_t) + \beta_4 (\text{EligiblewithASHA}_{ij} * \text{Post1}_t) \\
& + \beta_5 \text{AddEligiblewithoutASHA}_{ij} + \beta_6 \text{AddEligiblewithASHA}_{ij} \\
& + \beta_7 (\text{AddEligiblewithoutASHA}_{ij} * \text{Post2}_t) + \beta_8 (\text{AddEligiblewithASHA}_{ij} * \text{Post2}_t) \\
& + X'_{ij} \delta + \mu_t + \gamma_j + \epsilon_{ijt} \quad (1)
\end{aligned}$$

Y_{ijt} is the outcome variable of the mother i in the state j giving her latest birth in year t . $\text{EligiblewithoutASHA}_{ij}$ is one of the treatment variables which takes value 1 for the mother who is eligible for cash assistance as per the first guideline in the state where ASHA is not available, i.e. the HPS. Similarly, $\text{EligiblewithASHA}_{ij}$ is her counterpart group in the state where ASHA is available, i.e. the LPS. They are whom I refer to as the *first phase eligible* mothers. β_1 and β_2 capture the difference in means of these two groups with the control group (i.e. the *Ineligibles*) prior to the intervention. Post1_t takes value 1 for the births that took place

²¹Joshi & Sivaram (2014) also consider the intervention period in two phases. However they do not incorporate the updated eligibility status of the mothers in the second phase.

after April 2005. An interaction of $Post1_t$ with each of these two eligibility groups gives how different the expected mean change in outcome was from before to after the first guideline was introduced, between the eligibility group and the control group. In other words, β_3 gives the treatment effect of only the mother's package on the first phase mother in the HPS, and β_4 gives the treatment effect of the mother's and ASHA's package on the first phase eligible mother in the LPS. Now, by comparing β_3 and β_4 , one would be able to say that the ASHA's presence drives the difference in effect.

Then comes the $AddEligiblewithoutASHA_{ij}$ which is a dummy variable for the mother who was not eligible according to the first guideline, but newly eligible for cash assistance as per the second guideline in the HPS (where ASHA remains unavailable). Similarly, $AddEligiblewithASHA_{ij}$ is a dummy variable for her counterpart in the LPS. They are whom I refer to as the *second phase eligible* mothers. β_5 and β_6 capture the difference in means of these two groups with the *Ineligibles* before the intervention. $Post2_t$ takes value 1 for the births that took place after October 2006. An interaction of $Post2_t$ with the $AddEligiblewithoutASHA_{ij}$ and $AddEligiblewithASHA_{ij}$ respectively, gives the difference-in-difference effect of the programme on the mothers who became eligible only after the second guideline took effect, in comparison to the control group. Essentially, β_7 gives the treatment effect of only the mother's package on the second phase mother in the HPS, and β_8 gives the treatment effect of the mother's and ASHA's package on the second phase eligible mother in the LPS. A comparison of β_7 and β_8 tells that the ASHA's presence drives the difference in effect.

To take into account any confounding effect arising due to the heterogeneity in the roll-out of the programme across states, I include state fixed effects denoted by γ_j . Also, it is worth mentioning here that a few other maternity programmes were in effect during JSY's study period here.²² However, these programmes were implemented at state-level; therefore, a state fixed effect should eliminate any confounding effect arising from their availability. Furthermore, any unobservable effect arising due to specific birth-years of the latest births by the mothers is absorbed by the birth-year fixed effect denoted by μ_t .

Finally, X_{ij} constitutes the set of control variables at individual, household and village infrastructure levels. The individual-specific variables are the number of births the mother has had, her maximum schooling years, her age during her latest birth. Household-specific variables comprise of wealth decile, the status of socially backward class, the religion of the household. Of the village infrastructural variables, the presence of child welfare development programme and the distances to the nearest primary health centre, community health centre and district-level public hospital are included.

4.3. Summary statistics

In **Table 1**, I present the pre-intervention summary statistics of the dependent variables of interest and also, various covariates related to the mother and the household across the five comparison groups. Some of the covariates' means are significantly different across these groups because of the very nature of the group

²²To my knowledge, *Dr Muthulakshmi Maternity Benefit Scheme* which was launched in 1987 in the state of Tamil Nadu, continued to be in effect during JSY. The state of Orissa launched a conditional electronic cash transfer programme *Mamata* in October 2011, which is later than JSY's study period in this paper.

composition that depended on the residence, wealth status, social status, age and birth history. Moreover, it can be seen from the means of the dependent variables that the first phase eligible mothers in the LPS, denoted by *EligiblewithASHA* in Column (3) of Table 1, were the worst performers in the pre-intervention years. Naturally, on them lay the highest focus of the programme.

In **Table 2**, I also report the summary statistics related to the births before and after the introduction of the programme; I present this as an average across all the groups to verify if the average composition of the mothers giving birth pre and post-intervention changed substantially. Table 2 summarises that in the pre-intervention years, a typical mother would have less than two live births including her latest birth, would be about 24 years old, with at most four years of schooling and belonging to a household in the third quintile of wealth distribution. In the post-intervention years, however, a typical mother would have, on average 2.7 births, including her latest, and would be about 25 years old. Concerning other characteristics such as maximum schooling years and wealth level of the household, the average remained the same as in pre-intervention years. With regards to characteristics such as religion, the averages pre and post-intervention remain similar, - with almost 80% of the mothers being Hindu by religion and about 14% mothers being Muslim. However, rural births increased from 74% to over 80%, and the socially backward classes representation rose from 74 to 77% after the programme started. The increase in the average live births by a mother (1.42 to 2.68) suggests that mothers' birth rate rose post-intervention. Nonetheless, the presence of a similar percentage of eligible mothers (any type) both in the pre and post-intervention columns suggest that all groups, including the *Ineligibles*, experienced this increase in the birth rate. Closer scrutiny (*not shown here*) reveals that in each eligibility group, the mean of total births by the mother increased, but remained below 2 in the post-intervention period. The only exceptions were *AddEligiblewithASHA_{ij}* (i.e. the second phase eligibles in LPS) whose mean jumped from 1.65 to 3.13 and the *Ineligibles* who moved from an average of 1.38 to 2.27, thus pushing the average across all groups over 2.²³

5. Main results

This section presents the main results based on **Equation (1)**. As a general overview, the results suggest that the introduction of the cash assistance programme had a positive and statistically significant effect on the eligible women in both phases of the programme in comparison to the women who never became eligible. Evidence shows that eligible women in the LPS, i.e. those who received both the cash assistance as well as the ASHA counselling, benefitted more than the eligible women in the HPS, i.e. those who only received the cash assistance.

In the following subsections, I discuss the effect on different outcome variables.

²³As a side note, one could argue that the increase in the birth rate in all the treatment groups is an unanticipated effect of the intervention itself (i.e. it made giving birth an easier choice in the families). However, a similar increase in the mean birth rate among the *Ineligibles* does not confirm that it is exclusively due to the intervention.

Table 1: Summary statistics of key variables before intervention

Variables	(1) Ineligibles Mean(SD)	(2) Eligible withoutASHA Mean(SD)	(3) Eligible withASHA Mean(SD)	(4) AddEligible withoutASHA Mean(SD)	(5) AddEligible withASHA Mean(SD)
<i>Dependent variables</i>					
Institutional births	0.25 (0.43)	0.21 (0.40)	0.06 (0.24)	0.27 (0.45)	0.15 (0.36)
Atleast 3 ANC's	0.80 (0.40)	0.56 (0.50)	0.16 (0.37)	0.69 (0.46)	0.38 (0.49)
Breastfed within 1-2 hr of birth	0.43 (0.49)	0.39 (0.49)	0.13 (0.34)	0.41 (0.49)	0.21 (0.40)
Child received BCG	0.88 (0.33)	0.74 (0.44)	0.43 (0.49)	0.84 (0.37)	0.64 (0.48)
<i>Individual control variables</i>					
Total births by mother	1.38 (0.99)	1.07 (0.26)	1.04 (0.18)	1.07 (0.26)	1.65 (1.56)
Age during latest birth	23.40 (4.63)	24.23 (4.61)	25.81 (5.27)	22.25 (4.59)	24.03 (5.62)
Max.schooling yrs. of mother	6.85 (4.99)	1.89 (3.56)	0.90 (2.48)	4.56 (4.70)	3.82 (4.88)
Hindu	0.75 (0.43)	0.80 (0.40)	0.88 (0.33)	0.82 (0.38)	0.83 (0.38)
Muslim	0.16 (0.37)	0.15 (0.36)	0.11 (0.31)	0.20 (0.14)	0.15 (0.36)
SC/ST/OBC	0.56 (0.50)	0.80 (0.40)	0.88 (0.33)	0.99 (0.08)	0.75 (0.44)
Wealth quintile	3.73 (1.12)	1 (0)	1 (0)	3.05 (1.11)	2.97 (1.26)
Rural	0.64 (0.48)	1 (0)	0.91 (0.28)	0.76 (0.43)	0.72 (0.45)
Observations	40172	4124	25209	14600	80401

Notes: Data used from DLHS 2 and 3. The sample consists of mothers with reported last birth between 2001 and 2004.

Table 2: Summary statistics of key variables pre and post intervention

Variables	Births post-intervention Mean (SD)	Births pre-intervention Mean (SD)	Std. Difference
Total births by mother	2.68 (1.89)	1.42 (1.22)	0.79
Age during latest birth	24.85 (5.22)	23.99 (5.31)	0.16
Max.schooling yrs. of mother	4.31 (4.92)	4.13 (4.95)	0.04
Hindu	0.80 (0.40)	0.81 (0.39)	-0.03
Muslim	0.14 (0.35)	0.14 (0.34)	0.02
SC/ST/OBC	0.77 (0.42)	0.74 (0.44)	0.07
Wealth quintile	2.80 (1.41)	2.81 (1.41)	-0.01
Rural	0.82 (0.38)	0.74 (0.44)	0.20
Eligible for one/both package	0.74 (0.44)	0.76 (0.43)	-0.03
Observations	280840	102465	

Notes: Data used from DLHS 2 and 3. The sample consists of mothers with reported last birth between 2001 and 2008. The last column gives the standardised difference in means.

5.1. Institutional births

Table 3 Column (1) reports the effect on public institutional births. The coefficient of interaction between *Eligible without ASHA* and *Post1* indicates that the increase in institutional births among the first phase eligible mothers in a high-performing state where ASHA was not available, was 2.9 pp. ($p = 0.024$) greater than that among the control group *Ineligibles*. In contrast, the coefficient of interaction between *Eligible with ASHA* and *Post1* indicates that the increase among the first phase eligibles in a low-performing state where ASHA was available, was 7.1 pp. ($p = 0.000$) larger than that among *Ineligibles*. Therefore,

Table 3: Effects on Institutional births

Dependent variable:	Mother gave birth at public health facility		
	(1)	(2)	(3)
<i>First phase eligibles</i>			
Eligible without ASHA	0.008 (0.012)	0.017* (0.010)	0.001 (0.012)
Eligible with ASHA	0.011 (0.045)	-0.048 (0.048)	0.005 (0.054)
Eligible without ASHA*Post1	0.029** (0.013)	0.023* (0.013)	0.009 (0.013)
Eligible with ASHA*Post1	0.071*** (0.007)	0.058*** (0.007)	0.050*** (0.008)
<i>Second phase eligibles</i>			
Additional Eligible without ASHA	0.066*** (0.007)	0.048*** (0.007)	0.045*** (0.008)
Additional Eligible with ASHA	0.047 (0.045)	-0.032 (0.049)	0.034 (0.054)
Additional Eligible without ASHA*Post2	0.018** (0.009)	0.021** (0.010)	0.020** (0.010)
Additional Eligible with ASHA*Post2	0.067*** (0.006)	0.069*** (0.007)	0.078*** (0.008)
Constant	0.338*** (0.032)	0.389*** (0.033)	0.376*** (0.033)
State FE	Yes	Yes	Yes
Birth year FE	Yes	Yes	Yes
Controls	Yes	Yes	Yes
<i>F-test of equality between interaction coefficients of first phase eligibles</i>			
<i>F</i> -statistic	7.88	5.96	7.70
<i>p</i> -value	0.005	0.015	0.006
<i>F-test of equality between interaction coefficients of second phase eligibles</i>			
<i>F</i> -statistic	19.26	16.50	21.79
<i>p</i> -value	0.000	0.000	0.000
Baseline mean of Ineligibles	0.250	0.237	0.239
Observations	326338	255433	181590
R^2	0.118	0.124	0.126

Notes: (1) The unit of observation is the mother who had her latest birth between 2001-08. (2) Column (1) presents the estimates of a regression with the entire sample, Column (2) with only rural mothers and Column (3) with rural mothers with up to two live births. (3) **EligiblewithoutASHA** and **EligiblewithASHA** denote the respective pre-intervention difference in means of the first phase eligible mothers in HPS and LPS with the control group (Ineligibles). **EligiblewithoutASHA*Post1** and **EligiblewithASHA*Post1** denote the respective difference-in-difference effect of the programme on the first phase eligible mothers in HPS and LPS. **Add.ElignlewithoutASHA** and **Add.ElignlewithASHA** denote the respective pre-intervention difference in means of the second phase eligible mothers in HPS and LPS with the control group (Ineligibles). **Add.ElignlewithoutASHA*Post2** and **Add.ElignlewithASHA*Post2** denote the respective difference-in-difference effect of the programme on the second phase eligible mothers in HPS and LPS. **Post1** and **Post2** denote the births taking place after the onset of first guideline (Apr 2005) and the ones after the onset of the second guideline (Oct 2006). (4) An *F*-test of equality between the coefficients **ElignlewithoutASHA*Post1** and **ElignlewithASHA*Post1** (i.e.the first phase eligibles) show that they significantly different from each other (below 1% level). A similar *F*-test of equality between the coefficients **Add.ElignlewithoutASHA*Post2** and **Add.ElignlewithASHA*Post2** (i.e.the second phase eligibles) show that they significantly different from each other (below 1% level). (5) Control variables include number of live births the mother has had, maximum schooling years of the mother, her religion, if her family belongs to one of the socially backward classes, the wealth quantile of her household, and some village-specific health infra-structure controls like presence of other child welfare programme in the village, distance to the nearest primary health centre, community health centre, to the nearest district hospital. (6) Standard errors clustered at district level within parentheses. (7) The unadjusted R^2 values are reported here. (8) The mean of the outcome variable in the control group (Ineligibles) in the pre-intervention period is reported. (9) ***, **, * implies $p < 0.01$, < 0.05 , < 0.10 respectively.

the first set of mothers who were eligible for the cash assistance as well as the ASHA’s advice experienced more than two times increase in institutional birth rates than that by the first set of mothers who only had the cash assistance. Given only 25% of births by ineligible mothers were at public health facilities before the intervention, this increase was about 11% in the HPS and about 27% in the LPS.

Now, we look at the mothers who were not eligible for the programme benefits in the earlier phase but became eligible from the end of 2006. Among them, the ones who only received cash assistance (i.e. the ones in the HPS) experienced a 1.8 pp. ($p = 0.039$) increase in institutional births and the ones who received both the cash assistance and ASHA’s guidance, experienced 6.7 pp. ($p = 0.006$) increase relative to the ineligible mothers. It indicates that receiving the cash assistance helped the mothers in choosing to give birth at public institutions, and those who received the additional ASHA counselling showed an even better outcome. Now, any further conclusion regarding the separation of channels of effects requires caution here, as it needs comparison across the treatment groups which are compositionally quite different from each other.

It is hard to ignore that the various treatment groups, along with the control group, are compositionally quite different from each other in terms of their socio-economic indicators, birth history and residence. (For reference, see the various group compositions in **Figure B.3** of **Appendix B**) Firstly, the control group, i.e. the *Ineligibles* consists of a very heterogeneous mixture of mothers who are either above-poverty-line, or below-poverty-line but below 19 years of age, or not in a socially backward class, or with more than two births, in the rural and urban areas of HP states. This composition is quite different than, say, the *Eligible with ASHA* group, who are below-poverty-line and above 19 years old, with up to two live births in the rural and urban LPS. Therefore, this differential selection into the control and treatment groups might lead to some discrepancy in the interpretation of results. Secondly, the issue gets even more pronounced when one tries to decipher the additional effect of the ASHA’s presence by comparing the eligible mothers in LPS with that in HPS. Trying to homogenise the composition of the groups along the demographic indicators of the mothers could offer some solution to this twofold problem.

It is logical to expect that rural women do not vary much in their socio-economic indicators. Table 3 Column (2) shows the estimates of the same analysis but restricted to only rural mothers. However, the effect sizes remain more or less identical to those found with the entire sample.²⁴

A further constricted sample with rural and relatively new mothers, i.e. with less than two births, gives similar effect sizes for the respective treatment groups (Column (3)). However, note that the estimates of the first phase eligible mothers in the HPS lose their statistical significance in the sub-samples (Columns (2) and (3)). Thus, one cannot reject the possibility that the mother’s incentive alone has no effect on the

²⁴As a side note here, the only difference in Column (2) compared to Column (1) is that the respective baseline differences in means of the eligible mothers in LPS of both phases with the control group are now negative (see the coefficients of *Eligible with ASHA* and *Add.Elignable with ASHA*). It suggests that in the case of the whole sample (Column (1)), the relatively large baseline mean in institutional births in these two treatment groups is contributed by the urban population in the LPS. Also, in the rural sample, this anticipated negative difference in the baseline means in the births between the eligible women in LPS and the ineligible women, confirms the diagnosis that the women in the rural LPS had worse institutional birth outcomes in the first place.

institutional birth rate of these mothers.

Note that, when the groups are more homogenised now with rural (and with less than two births) mothers, the first phase groups *Eligible without ASHA* and *Eligible with ASHA* become demographically identical, i.e. they are below-poverty-line, above 19 years old, have less than two births and belong to rural areas. Due to this homogeneity, we can stress that the added effect seen in the eligible mothers in LPS compared to HPS is not due to any other systematic difference, but due to the ASHA's presence. Moreover, with this same argument that the first phase mothers in the LPS and HPS do not differ demographically in this sub-sample, we can minimise the possibility that the LPS mothers see better results due to the combined effect of the cash assistance and the ASHA's presence. While only the cash transfer to such mothers do not help improve institutional birth rates in the HPS, an additional ASHA's presence does that in the LPS. Also, the fact that the amount of cash transfer to these mothers was the same (700 INR) across the LPS and HPS, further consolidates that the added effect on the rural mothers (with less than two births) in the LPS is through the ASHA.²⁵

Having said that, it is to be noted that the use of the sub-sample of rural (and with less than two births) mothers renders only the first phase mothers in the LPS and HPS to be demographically identical. There, however, remains some difference in this regard among the second phase mothers across LPS and HPS.

5.2. Antenatal care

In this section I discuss the effect of the programme on the utilisation of ANC check-ups by the mothers.

The outcome variable considered here is a binary variable that takes value 1 for mothers who received at least three ANC's. **Table 4** reports the effect of the programme on antenatal care outcomes of the different treatment groups.²⁶ In Column (1), the coefficient of interaction between *Eligible without ASHA* and *Post1* indicates that the increase in the probability of having at least three ANC's by this group was 4.4 pp. ($p = 0.026$) more than the *Ineligibles*. In contrast, a similar interaction of the time variable with *Eligible with ASHA* indicates that the increase in the probability of receiving ANC by this group was 13.1 pp. ($p = 0.000$) higher than that experienced by the *Ineligibles*. Given that only 79.6% of the control group mothers had at least three ANC's in the baseline, the increase in the HPS mothers was 5.3% and about 19% in the LPS mothers.

Among the mothers who only became eligible from the end of 2006, those who received cash assistance only (i.e. the ones in the HPS) experienced a 1.2 pp. ($p = 0.090$) increase in ANC uptake and the ones who received both the cash assistance and ASHA's counsel, experienced a 4.0 pp. ($p = 0.000$) increase relative to the ineligible mothers.

²⁵Note when only the rural (and with less than two births) sub-sample is considered, the control group of *Ineligibles* still consists of a heterogeneous mixture of mothers who are either above-poverty-line, or below-poverty-line but below 19 years of age, or not in a socially backward class, (or with more than two births) in the rural areas of HP states. However, drawing the above inference should not be a problem if the control group differs by some extent in composition, as long as we compare the eligible mothers in LPS and HPS with the same control group.

²⁶Note that the number of observations used in the ANC analysis is smaller than that in the institutional births because of missing data.

Table 4: Effects on Antenatal care

Dependent variable:	Mother received at least three ANC's		
	(1)	(2)	(3)
<i>First phase eligibles</i>			
Eligible without ASHA	0.024 (0.016)	0.009 (0.015)	0.011 (0.015)
Eligible with ASHA	-0.115*** (0.033)	-0.145*** (0.035)	-0.138*** (0.044)
Eligible without ASHA*Post1	0.044** (0.020)	0.035* (0.019)	0.030 (0.019)
Eligible with ASHA*Post1	0.131*** (0.009)	0.115*** (0.010)	0.116*** (0.010)
<i>Second phase eligibles</i>			
Additional Eligible without ASHA	0.014*** (0.006)	0.005 (0.006)	0.001 (0.006)
Additional Eligible with ASHA	-0.070** (0.034)	-0.104*** (0.036)	-0.116*** (0.045)
Additional Eligible without ASHA*Post2	0.012* (0.007)	0.009 (0.009)	0.009 (0.009)
Additional Eligible with ASHA*Post2	0.040*** (0.006)	0.041*** (0.007)	0.068*** (0.008)
Constant	0.650*** (0.033)	0.703*** (0.033)	0.687*** (0.033)
State FE	Yes	Yes	Yes
Birth year FE	Yes	Yes	Yes
Controls	Yes	Yes	Yes
<i>F-test of equality between interaction coefficients of first phase eligibles</i>			
<i>F</i> -statistic	15.70	13.40	16.11
<i>p</i> -value	0.000	0.000	0.000
<i>F-test of equality between interaction coefficients of second phase eligibles</i>			
<i>F</i> -statistic	9.83	9.80	27.94
<i>p</i> -value	0.002	0.002	0.000
Baseline mean of Ineligibles	0.796	0.755	0.759
Observations	262024	198977	156835
<i>R</i> ²	0.301	0.280	0.313

Notes: (1) The unit of observation is the mother who had her latest birth between 2001-08. (2) Column (1) presents the estimates of a regression with the entire sample, Column (2) with only rural mothers and Column (3) with rural mothers with up to two live births. (3) **EligiblewithoutASHA** and **EligiblewithASHA** denote the respective pre-intervention difference in means of the first phase eligible mothers in HPS and LPS with the control group (Ineligibles). **EligiblewithoutASHA*Post1** and **EligiblewithASHA*Post1** denote the respective difference-in-difference effect of the programme on the first phase eligible mothers in HPS and LPS. **Add.ElignlewithoutASHA** and **Add.ElignlewithASHA** denote the respective pre-intervention difference in means of the second phase eligible mothers in HPS and LPS with the control group (Ineligibles). **Add.ElignlewithoutASHA*Post2** and **Add.ElignlewithASHA*Post2** denote the respective difference-in-difference effect of the programme on the second phase eligible mothers in HPS and LPS. **Post1** and **Post2** denote the births taking place after the onset of first guideline (Apr 2005) and the ones after the onset of the second guideline (Oct 2006). (4) An *F*-test of equality between the coefficients **EligiblewithoutASHA*Post1** and **EligiblewithASHA*Post1** (i.e.the first phase eligibles) show that they significantly different from each other (below 1% level). A similar *F*-test of equality between the coefficients **Add.ElignlewithoutASHA*Post2** and **Add.ElignlewithASHA*Post2** (i.e.the second phase eligibles) show that they significantly different from each other (below 1% level). (5) Control variables include number of live births the mother has had, maximum schooling years of the mother, her religion, if her family belongs to one of the socially backward classes, the wealth quantile of her household, and some village-specific health infra-structure controls like presence of other child welfare programme in the village, distance to the nearest primary health centre, community health centre, to the nearest district hospital. (6) Standard errors clustered at district level within parentheses. (7) The unadjusted *R*² values are reported here. (8) The mean of the outcome variable in the control group (Ineligibles) in the pre-intervention period is reported. (9) ***, **, * implies $p < 0.01$, < 0.05 , < 0.10 respectively.

The above findings indicate that receiving cash assistance helped the mothers significantly in utilising the ANC services. Nevertheless, those who received the additional ASHA counselling showed better outcomes. This pattern was similar in both phases.

Intending to conclude better on the ASHA's channel, I further examine if a similar result persists in a relatively more homogenised sample. Column (2) of Table 4 consists of analysis with only rural mothers, and Column (3) consists of analysis with rural mothers with less than two live births. We see that the DiD coefficients remain more or less unchanged in magnitude. However, only the findings on the eligible mothers in the low-performing state hold their precision in both phases (Columns (2) and (3)). As found in the case of institutional birth, this last finding on ANCs again underlines the possibility that when we consider the sub-sample(s) of only the rural mothers (and with less than two births), it is through the ASHA that the effect takes place.

5.3. Breastfeeding practices

In **Table 5** Column (1), with the entire sample, there was no statistically significant difference in the average increase in effect for the first set of eligible mothers in the HPS where there is no ASHA. However, the first set of eligible mothers in the LPS (who were 24.5 pp. ($p = 0.000$) less likely than the ineligible mothers to start breastfeeding within an hour in the baseline) experienced a disproportionately large increase of size 3.6 pp. ($p = 0.001$) in the probability of early breastfeeding in the post-intervention phase.

Among the second phase eligible mothers, the ones in the HPS did not experience any statistically significant difference in effect than the *Ineligibles*. In contrast, the eligible mothers in the LPS experience an increase which is 3.2 pp. ($p = 0.000$) higher than their ineligible counterparts. Therefore, to summarise, it is only the eligible mother in the LPS in both phases, with the ASHA by her side, who experiences a statistically significant effect of the programme on early breastfeeding practices.²⁷

Similar results persist when only the mothers in rural areas are considered, and furthermore, when rural mothers with less than two live births are considered (Table 5 Columns (2) and (3)).

Here, we clearly see that there was no effect of only the mother's package on the HPS mothers. Furthermore, the analysis with rural mothers (with less than two live births) confirms that if there were no effect of the cash transfers to mothers in the HPS, it would not affect the demographically similar mothers in the LPS either. So whatever effect we see in the LPS, is through the ASHA's presence.

5.4. BCG vaccinations

I examine if the programme had any effect on BCG vaccination given to the newborns. As already mentioned, to make the relevant variable on BCG coherent across the two waves of DLHS survey, I use a binary variable that only indicates whether the child received the BCG vaccine or not.

²⁷Note, however, the estimated post-intervention difference in means with the control group remains negative for the eligibles of LPS in both phases (main effect+interaction effect < 0).

Table 5: Effects on Breastfeeding practices

Dependent variable:	Mother started breastfeeding within 1-2 hours of birth		
	(1)	(2)	(3)
<i>First phase eligibles</i>			
Eligible without ASHA	0.042*** (0.015)	0.037*** (0.015)	0.038*** (0.014)
Eligible with ASHA	-0.245*** (0.053)	-0.252*** (0.053)	-0.268*** (0.065)
Eligible without ASHA*Post1	-0.006 (0.019)	-0.013 (0.018)	-0.018 (0.018)
Eligible with ASHA*Post1	0.036*** (0.010)	0.030*** (0.010)	0.029*** (0.011)
<i>Second phase eligibles</i>			
Additional Eligible without ASHA	0.021*** (0.008)	0.011 (0.009)	0.019** (0.009)
Additional Eligible with ASHA	-0.238*** (0.055)	-0.248*** (0.054)	-0.263*** (0.067)
Additional Eligible without ASHA*Post2	-0.004 (0.010)	-0.006 (0.011)	0.003 (0.011)
Additional Eligible with ASHA*Post2	0.032*** (0.007)	0.028*** (0.008)	0.046*** (0.010)
Constant	0.688*** (0.035)	0.703*** (0.035)	0.661*** (0.034)
State FE	Yes	Yes	Yes
Birth year FE	Yes	Yes	Yes
Controls	Yes	Yes	Yes
<i>F-test of equality between interaction coefficients of first phase eligibles</i>			
<i>F</i> -statistic	3.60	4.00	4.97
<i>p</i> -value	0.058	0.046	0.026
<i>F-test of equality between interaction coefficients of second phase eligibles</i>			
<i>F</i> -statistic	8.03	6.68	8.12
<i>p</i> -value	0.005	0.010	0.005
Baseline mean of Ineligibles	0.426	0.420	0.415
Observations	309440	242111	171327
<i>R</i> ²	0.173	0.177	0.186

Notes: (1) The unit of observation is the mother who had her latest birth between 2001-08. (2) Column (1) presents the estimates of a regression with the entire sample, Column (2) with only rural mothers and Column (3) with rural mothers with up to two live births. (3) **EligiblewithoutASHA** and **EligiblewithASHA** denote the respective pre-intervention difference in means of the first phase eligible mothers in HPS and LPS with the control group (Ineligibles). **EligiblewithoutASHA*Post1** and **EligiblewithASHA*Post1** denote the respective difference-in-difference effect of the programme on the first phase eligible mothers in HPS and LPS. **Add.ElignlewithoutASHA** and **Add.ElignlewithASHA** denote the respective pre-intervention difference in means of the second phase eligible mothers in HPS and LPS with the control group (Ineligibles). **Add.ElignlewithoutASHA*Post2** and **Add.ElignlewithASHA*Post2** denote the respective difference-in-difference effect of the programme on the second phase eligible mothers in HPS and LPS. **Post1** and **Post2** denote the births taking place after the onset of first guideline (Apr 2005) and the ones after the onset of the second guideline (Oct 2006). (4) An *F*-test of equality between the coefficients **EligiblewithoutASHA*Post1** and **EligiblewithASHA*Post1** (i.e.the first phase eligibles) show that they significantly different from each other (below 5% level). A similar *F*-test of equality between the coefficients **Add.ElignlewithoutASHA*Post2** and **Add.ElignlewithASHA*Post2** (i.e.the second phase eligibles) show that they significantly different from each other (below 1% level). (5) Control variables include number of live births the mother has had, maximum schooling years of the mother, her religion, if her family belongs to one of the socially backward classes, the wealth quantile of her household, and some village-specific health infra-structure controls like presence of other child welfare programme in the village, distance to the nearest primary health centre, community health centre, to the nearest district hospital. (6) Standard errors clustered at district level within parentheses. (7) The unadjusted *R*² values are reported here. (8) The mean of the outcome variable in the control group (Ineligibles) in the pre-intervention period is reported. (9) ***, **, * implies $p < 0.01$, < 0.05 , < 0.10 respectively.

Let us first discuss the estimates for the mothers who became eligible according to the first guideline, as reported in **Table 6** Column (1). The eligible mothers in a high-performing state with no ASHA present

Table 6: Effects on BCG vaccination

Dependent variable:	If the newborn received BCG vaccine		
	(1)	(2)	(3)
<i>First phase eligibles</i>			
Eligible without ASHA	0.043*** (0.017)	0.039** (0.016)	0.040*** (0.015)
Eligible with ASHA	-0.071*** (0.028)	-0.076*** (0.030)	-0.051 (0.035)
Eligible without ASHA*Post1	0.043** (0.019)	0.025 (0.019)	0.004 (0.018)
Eligible with ASHA*Post1	0.224*** (0.011)	0.206*** (0.011)	0.190*** (0.011)
<i>Second phase eligibles</i>			
Additional Eligible without ASHA	0.037*** (0.005)	0.037*** (0.006)	0.039*** (0.006)
Additional Eligible with ASHA	0.029 (0.027)	0.018 (0.030)	0.027 (0.035)
Additional Eligible without ASHA*Post2	0.008 (0.007)	-0.002 (0.009)	0.002 (0.009)
Additional Eligible with ASHA*Post2	0.063*** (0.005)	0.059*** (0.006)	0.087*** (0.008)
Constant	0.657*** (0.040)	0.678*** (0.040)	0.551*** (0.041)
State FE	Yes	Yes	Yes
Birth year FE	Yes	Yes	Yes
Controls	Yes	Yes	Yes
<i>F-test of equality between interaction coefficients of first phase eligibles</i>			
<i>F</i> -statistic	67.10	67.06	73.99
<i>p</i> -value	0.000	0.000	0.000
<i>F-test of equality between interaction coefficients of second phase eligibles</i>			
<i>F</i> -statistic	37.23	36.21	58.95
<i>p</i> -value	0.000	0.000	0.000
Baseline mean of Ineligibles	0.877	0.867	0.865
Observations	326338	255433	181590
R^2	0.154	0.147	0.190

Notes: (1) The unit of observation is the mother who had her latest birth between 2001-08. (2) Column (1) presents the estimates of a regression with the entire sample, Column (2) with only rural mothers and Column (3) with rural mothers with up to two live births. (3) **EligiblewithoutASHA** and **EligiblewithASHA** denote the respective pre-intervention difference in means of the first phase eligible mothers in HPS and LPS with the control group (Ineligibles). **EligiblewithoutASHA*Post1** and **EligiblewithASHA*Post1** denote the respective difference-in-difference effect of the programme on the first phase eligible mothers in HPS and LPS. **Add.ElignablewithoutASHA** and **Add.ElignablewithASHA** denote the respective pre-intervention difference in means of the second phase eligible mothers in HPS and LPS with the control group (Ineligibles). **Add.ElignablewithoutASHA*Post2** and **Add.ElignablewithASHA*Post2** denote the respective difference-in-difference effect of the programme on the second phase eligible mothers in HPS and LPS. **Post1** and **Post2** denote the births taking place after the onset of first guideline (Apr 2005) and the ones after the onset of the second guideline (Oct 2006). (4) An *F*-test of equality between the coefficients **EligiblewithoutASHA*Post1** and **EligiblewithASHA*Post1** (i.e.the first phase eligibles) show that they significantly different from each other (below 1% level). A similar *F*-test of equality between the coefficients **Add.ElignablewithoutASHA*Post2** and **Add.ElignablewithASHA*Post2** (i.e.the second phase eligibles) show that they significantly different from each other (below 1% level). (5) Control variables include number of live births the mother has had, maximum schooling years of the mother, her religion, if her family belongs to one of the socially backward classes, the wealth quantile of her household, and some village-specific health infra-structure controls like presence of other child welfare programme in the village, distance to the nearest primary health centre, community health centre, to the nearest district hospital. (6) Standard errors clustered at district level within parentheses. (7) The unadjusted R^2 values are reported here. (8) The mean of the outcome variable in the control group (Ineligibles) in the pre-intervention period is reported. (9) ***, **, * implies $p < 0.01$, < 0.05 , < 0.10 respectively.

experienced 4.3 pp. ($p = 0.022$) increase in the BCG vaccination of their newborns. On the other hand, the eligible mothers in the low-performing state, who had a baseline mean difference of 7.1 pp. ($p = 0.010$) with the *Ineligibles*, experienced a disproportionately large difference in the effect of size 22.4 pp. ($p = 0.000$).

Among the mothers who were not eligible at first but later became so according to the second guideline, those in the LPS experienced a relatively large difference in effect (6.8 pp. ($p = 0.000$)) than the *Ineligibles*, compared to their counterparts in the HPS who did not experience any significant effect.

Furthermore, by restricting the sample to only rural mothers, and then to rural mothers with less than two live births, the results do not change in any meaningful way. However, only the findings on the eligible mothers in LPS hold their precision in both phases (Columns (2) and (3) respectively of Table 6). This result is again quite similar to the findings of the other outcome variables. Therefore, similarly again, we can conclude on the superiority of the ASHA's channel on the rural mothers (with less than two live births).

Summarising the results of Section 5, we can say that the eligible mothers in a low-performing state experienced large effects in all outcomes. In contrast, the eligible mothers in a high-performing state had a relatively small effect (in institutional birth, ANC and BCG) or no effect (in breastfeeding). Also, the effect sizes are more prominent for the first phase mothers in comparison to the second phase mothers. Finally, examining the effects across a more comparable sub-sample of rural mothers with less than two births, the effect remains statistically significant only for the eligible mothers in the LPS. This last finding implies that the mother's package alone did not affect those mothers. Also, since it is possible to compare demographically identical mothers across the LPS and HPS (only the first phase ones) with the sub-sample of rural mothers (and with less than two births), we can confidently attribute the effect found in the LPS to the ASHA's performance. This is under the assumption that demographically identical mothers in rural areas (and with up to two births) do not otherwise behave differently across LPS and HPS.

6. Robustness checks

In this section, I discuss various issues that could bias my findings and the measures I take to mitigate them. In Section 6.1, I argue the causality of the effects found, by validating the parallel pre-trends assumption of difference-in-difference strategy. In Section 6.2, I return to the issue of heterogeneity in the observable characteristics of the mothers that could render the findings to suffer from differential selection bias. Therefore, as a robustness measure, I combine coarsened exact matching with DiD. Finally, in Section 6.3, I discuss the issue of systematic differences in the low and high-performing states that could lead to the statistical issue of regression to the mean and thus bias my conclusion. As a solution, I present an extended analysis with the HPS sample only before and after the introduction of ASHA and compare the findings with the previous ones.

6.1. Parallel pre-trend issue

The identifying assumption of a DiD approach is that the growth of the outcome variables would follow the same trend in the treatment and control groups in the absence of the intervention. Under this assumption, it is possible to decipher the average causal effect on the treated in the post-intervention period. Although the very construction of the assumption renders itself untestable, a typical way of getting the closest validation is to check if the outcomes of interest evolved with a similar trend in the treatment and control groups in the pre-intervention years.

When it comes to the JSY programme, the eligibility was determined based on the health outcomes, e.g. institutional births; therefore, it is evident that the different eligibility groups should be at different levels in the pre-intervention period. However, as long as we can ensure that the pre-trends are parallel across the groups, the estimated effects should be unbiased. While a mere visual inspection of the trends of the outcome variables across the groups is a good starting point, a more robust way to verify this is to plot the estimated coefficients of the interaction of the eligibility and year of the latest birth by the mother. Also, as there are multiple treatment groups in the model, it is more meaningful to investigate the plots of the relevant coefficients in the estimated model than to look at the raw trend plots of each treatment category with respect to the control group.

I estimate a variant of Equation (1) as follows:

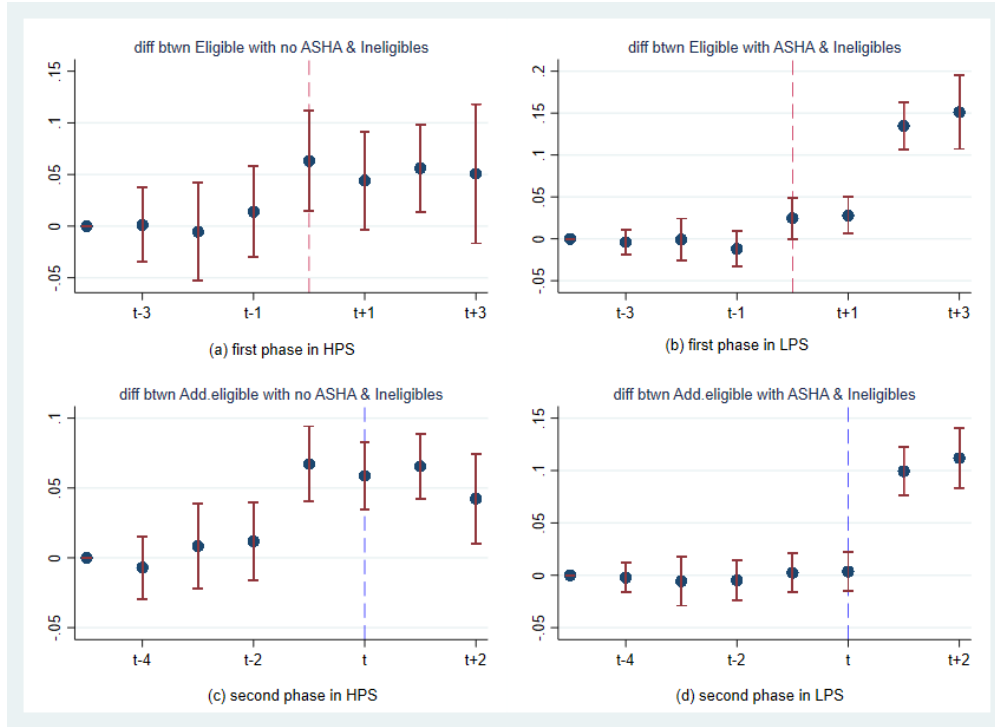
$$\begin{aligned}
Y_{ijt} = & \alpha + \mu_t + \beta_1 \text{EligiblewithoutASH} A_{ij} + \sum_{t=2001}^{2008} \beta_t \text{EligiblewithoutASH} A_{ij} * \text{lastbirthyear}_t \\
& + \beta_2 \text{EligiblewithASH} A_{ij} + \sum_{t=2001}^{2008} \beta_t \text{EligiblewithASH} A_{ij} * \text{lastbirthyear}_t \\
& + \beta_3 \text{AddEligiblewithoutASH} A_{ij} + \sum_{t=2001}^{2008} \beta_t \text{AddEligiblewithoutASH} A_{ij} * \text{lastbirthyear}_t \\
& + \beta_4 \text{AddEligiblewithASH} A_{ij} + \sum_{t=2001}^{2008} \beta_t \text{AddEligiblewithASH} A_{ij} * \text{lastbirthyear}_t \\
& + X'_{ij} \delta + \gamma_j + \epsilon_{ijt} \quad (2)
\end{aligned}$$

Note in **Equation (2)**, lastbirthyear_t are the year dummies of the latest births by the mothers. The other notations bear the same meaning as in Equation (1).

6.1.1. Institutional birth pre-trends

Figure 2 suggests no statistically significant difference in the effect on institutional birth for the first phase eligible mothers in the high-performing state as well as those in the low-performing state in comparison to the ineligible mothers, before the intervention started. This finding confirms the presence of parallel pre-trends in institutional births for the first phase eligible mothers compared to the ineligible mothers. It is only post-2005, i.e. after the roll-out of the first phase, one can see some positive difference in effect for

Figure 2: Time-varying difference in institutional births between the respective treatment groups and control group



Notes: This figure shows the difference between each treated sub-group and the control group in the probability of giving birth at public healthcare institutions during 2001-08. The two figures in the upper panel show the intervention onset in $t=2005$ for the first phase eligibles, and the two figures below show the intervention onset in $t=2006$ for the second phase eligibles.

these two eligible groups. The parallel pre-trend assumption also holds strong for the group of mothers that became eligible in the second phase in the LPS in late-2006; until that year, the interaction coefficient remains statistically insignificant. However, the assumption breaks for the group of second phase eligible mothers in HPS. As plot (c) of Figure 2 suggests, the difference in means with the control group already becomes statistically significant for this treatment group in 2005, which is one year before this particular group became eligible for the programme benefits. Perhaps, the finding is not that surprising. Since the first phase eligible mothers started receiving the programme benefits already in 2005, it could be attributed to a positive spillover of information that led these otherwise socio-economically similar mothers in the urban areas to opt for institutional births already in 2005. (Note: in an HPS, a share of the newly eligible second phase mothers are socio-economically almost similar to the first phase eligible mothers; they only differ in that they come from the urban areas.) Furthermore, it could be so that due to fuzzy information on mother's eligibility in the first phase, the below-poverty-line mothers in urban areas of HPS also believed that they were eligible in the first phase, while in reality, only their rural counterparts were.

6.1.2. Antenatal care pre-trends

Figure 3 clearly invalidates the prevalence of parallel trends across all the groups, in the pre-intervention

phase, except for the first phase eligibles in the HPS. Focusing on plots (a) and (b) of Figure 3 which investigate the first phase mothers, one can see that there was some clear effect on the two eligible groups' ANC utilisation, especially in the LPS. However, that particular treatment group, i.e. *Eligible with ASHA* seems to have evolved in its ANC uptake in a different way than the *Ineligibles*, in the baseline. As a result, one cannot stress the causality in the effect of the programme on this group's ANC take-up. While plots (c) and (d) in the same graph indicate some positive spillover effect already in 2005 on the second phase eligibles, a statistically significant difference in the means of the eligibles in the LPS and the control group already in years 2003 and 2004 cautions us from drawing any causal inference.

Furthermore, a closer scrutiny of the raw pre-trends of the variable of interest (**Figure A.1** plot (a) in **Appendix A**) shows that the *Ineligibles* and the *Additional Eligible with ASHA* (i.e. the second phase eligibles in LPS) followed a different trend than the other three groups; while the latter showed an upward trend in this outcome, the former showed a dip in the year 2004. Though there is no firm explanation for this, one must note that the three groups *Eligible with ASHA*, *Eligible without ASHA* and *Additional Eligible without ASHA* (i.e. the first phase eligibles in both state-types and the second phase eligible in HPS) comprise mostly of mothers with similar characteristics, i.e. with up to two live births, belonging to below-poverty-line and socially disadvantaged families. On the other hand, the other two groups *Additional Eligible with ASHA* and *Ineligible* comprise of a heterogeneous mix of mothers (above-poverty-line, or not socially disadvantaged or more than two live births). Another raw plot (b) of pre-trends by using the sub-sample of only rural mothers with up to two live births, however, gives a more comparable sketch of the trends across the groups. Thus again referring to the full sample plot (a), the socio-economically disadvantaged mothers with less than two births, appear to have received information and/or service related to ANC in a different way than the other mothers during 2004. The simultaneous dip in the uptake of ANC in 2004 in the two groups *Ineligibles* and the *Additional Eligible with ASHA* in plot (a), could also imply reallocation of limited supply resources in the year immediately before the intervention was announced.

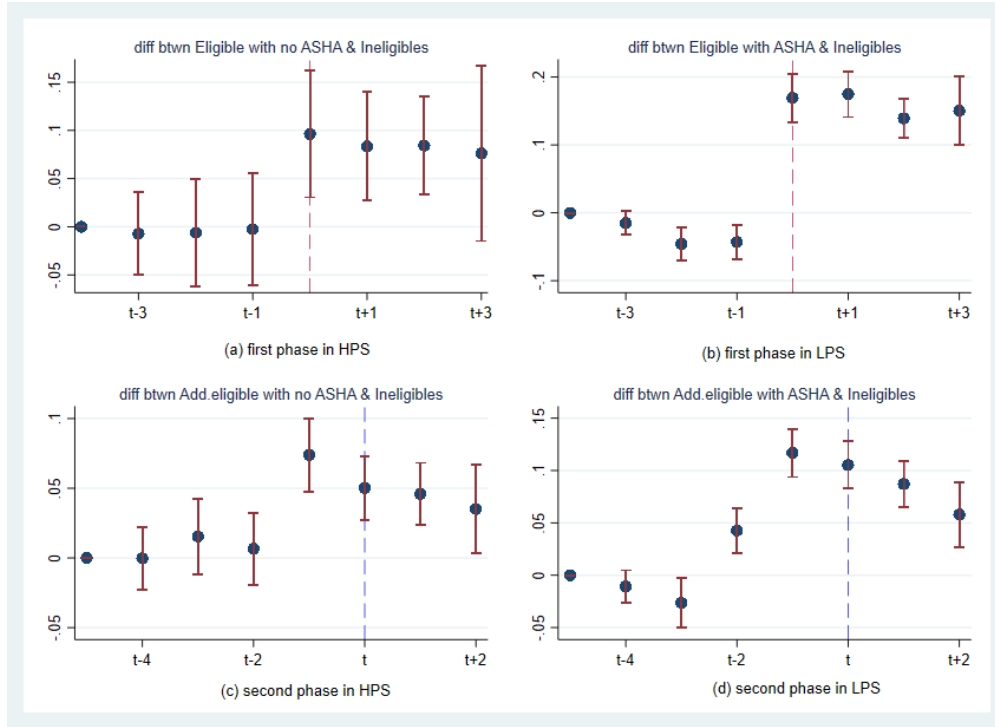
6.1.3. Breastfeeding practices pre-trends

As given by the event-study plots in **Figure 4**, the parallel pre-trends assumption holds for the first phase eligibles in both state-types. It only fails in case of the second phase eligible mothers in the LPS. Arguably, the smoothly rising trend in the last plot of the graph most likely captures the general increasing trend in early breastfeeding practices of the newly eligible mothers of the second phase in the LPS, because this particular treatment group is basically a representation of all mothers who gave birth during the second phase, irrespective of their socio-economic backgrounds or birth history.

6.1.4. BCG vaccination pre-trends

From the event study plots in **Figure 5**, we can see that there is no statistically significant difference in the receipt of BCG vaccinations in the pre-intervention years for the first phase eligible mothers in the LPS, in comparison to the ineligible mothers (plot(b)). However, all other eligible group seem to have evolved in

Figure 3: Time-varying difference in antenatal care check-ups between the respective treatment groups and control group



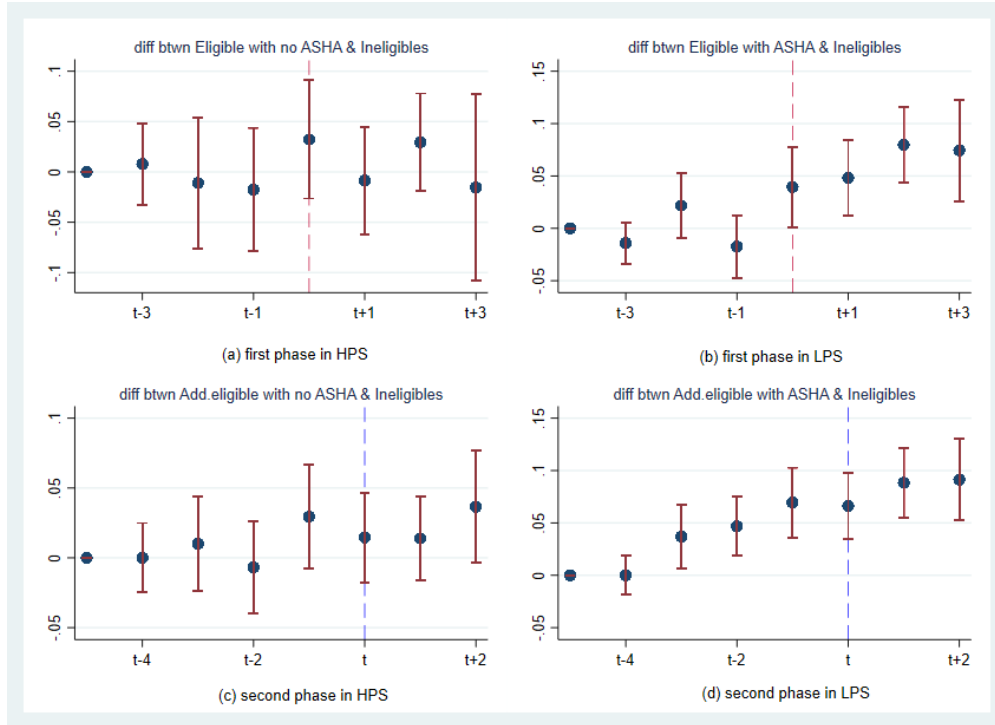
Notes: This figure shows the difference between each treated sub-group and the control group in the probability of receiving atleast 3 ANC's during 2001-2008. The two figures in the upper panel show the intervention onset in t=2005 for the first phase eligibles, and the two figures below show the intervention onset in t=2006 for the second phase eligibles.

a different path in their BCG uptake. Again a closer investigation of the raw pre-intervention trends reveals that all groups suffered a drop in BCG uptake in 2004, some of them quite sharp ones compared to the control group (**Appendix A Figure A.2**). Even by restricting the sample to rural mothers with less than two live births, similar trend pattern prevails.²⁸

Summing up the verification results of the pre-intervention trends of the variables of our interest in Section 6.1, it can be safely concluded that there was clearly some causal effect of the programme on institutional births and breastfeeding practices, and clearly quite large for the first phase eligible mothers in the low-performing states where ASHA was available. Though we cannot confirm that the outcome was similar for the second phase eligible mothers, at the same time, we cannot expect a clean presence of parallel pre-trends for the late-eligible groups, because interventions of such immense magnitude are bound to have

²⁸Note that some data issues could also drive this drop in the uptake. The variable on BCG uptake used here is created from two different variables in the two waves of the survey. DLHS 2, which is until 2004, has information on whether or not the BCG vaccine was given to the child, whereas DLHS 3, which starts with later births, has information on the date of BCG vaccination received. It is difficult to discard any discrepancy arising from the construction of the study variable. Also, it is not easy to compare with findings across other studies because they either vary in their specification of the treatment groups or use of data (e.g. Debnath (2018) avoids sub-categorisation of eligibles unlike me, and uses only one survey wave DLHS 3 for his analysis).

Figure 4: Time-varying difference in breastfeeding practices between the respective treatment groups and control group



Notes: This figure shows the difference between each treated sub-group and the control group in the probability of breastfeeding at birth during 2001-2008. The two figures in the upper panel show the intervention onset in $t=2005$ for the first phase eligibles, and the two figures below show the intervention onset in $t=2006$ for the second phase eligibles.

spillover effects. Keeping this in mind, I argue that the confirmation of parallel pre-trends only for the first phase eligibles would be sufficient to assert that the introduction of the programme had a causal effect on institutional births and early breastfeeding.

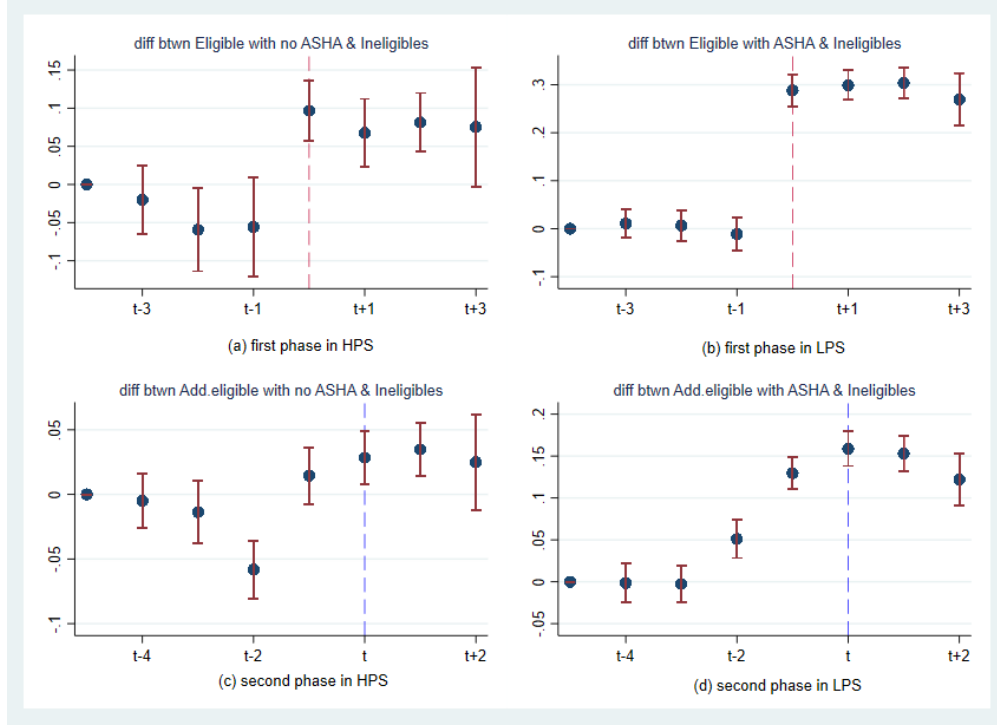
However, for ANC and BCG uptakes, the parallel pre-trends verifications do not hold simultaneously for even the two first phase eligible groups. Hence, it is difficult to compare the causality in effects across the LPS and HPS for these outcomes.²⁹

6.2. Coarsened Exact Matching

As a further robustness check to the empirical results obtained in the previous section, I employ a Coarsened Exact Matching (CEM) approach to the sample. CEM is a monotonic imbalance-reducing matching method implementable on observational data and is capable of improving the estimation of causal inference (Iacus et al., 2012). In order to minimise the imbalance between the treatment and control groups in this otherwise quite heterogeneous sample of mothers, I employ CEM based on observable characteristics of the mother. The covariates which I use for this procedure are the number of live births the mother has had, her

²⁹Note that an introduction of group-specific linear trends is not feasible here. Due to the presence of multiple treatment groups in the model, one of the groups gets omitted due to multicollinearity when group-specific linear trends are used.

Figure 5: Time-varying difference in BCG vaccination between the respective treatment groups and control group



Notes: This figure shows the difference between each treated sub-group and the control group in the probability of getting the child BCG vaccinated during 2001-2008. The two figures in the upper panel show the intervention onset in t=2005 for the first phase eligibles, and the two figures below show the intervention onset in t=2006 for the second phase eligibles.

age when she gave birth to her last child, her religion - Hindu or Muslim, social caste and wealth decile of her household.

The global balance between the treated and control units in the data is measured using the \mathcal{L}_1 index (Iacus et al., 2011, 2012),

$$\mathcal{L}_1 = \frac{1}{2} \sum_{l_1 \dots l_k \in H(x)} |f_{l_1} \dots f_{l_k} - g_{l_1} \dots g_{l_k}| \quad (3)$$

where $f_{l_1} \dots f_{l_k}$ and $g_{l_1} \dots g_{l_k}$ are the relative frequencies of treated and control observations belonging to the cells with coordinates $l_1 \dots l_k$ in the multivariate cross tabulation (H). Conditioning on the coarsening level of the covariates, the empirical distributions before and after CEM are completely separated when $\mathcal{L}_1 = 1$, while if the distributions perfectly overlap $\mathcal{L}_1 = 0$. A good matching performance is achieved if \mathcal{L}_1 of the matched population is less than \mathcal{L}_1 of the original population.

One issue with using CEM, however, is that it allows for only one treatment and one control group. Under such circumstances, there are two approaches that I could take here: (i) classify those who have been treated at any point with either mother's package or both packages, as *treated*, and those who have never

been treated with any package, as the *control* and then *coarsen* over specific covariates;³⁰ (ii) If there are multiple treatment groups, consider each pair (with the control group) separately and estimate the *average treatment effect on the treated* for each group.

On applying approach (i) in my sample by using the characteristics mentioned above of the mothers, the \mathcal{L}_1 value of imbalance between the treated and control group reduces from 0.56 to 0.18. In the process of achieving this lesser imbalance, 1464 and 96926 observations are dropped from the original control and treatment groups, respectively. This pruning results in the loss of 30% of the original number of observations.

When the sample becomes more balanced through CEM, the effect on the eligibles in the high-performing state in both phases becomes statistically insignificant. In contrast, the effect on the eligibles in the low-performing state in both phases remains of similar size and precision. This finding is similar to that found in the main analyses with the homogenised sub-sample of rural mothers (and with less than two births). **Table 7** Column (1) shows that in the case of institutional births, the difference in effect for the *Eligible with ASHA* and *Additional Eligible with ASHA* groups relative to the control group are 7.1 pp. ($p = 0.000$) and 6.8 pp. ($p = 0.000$) respectively. The findings on ANC and BCG uptake also show a similar pattern - only the eligible mothers in LPS in both phases see any statistically significant difference in effect in the CEM sample (Columns (2) and (4) of Table 7). For the outcome on breastfeeding at birth, only the estimate of the second phase eligible mothers in the LPS remains precise (Column (3) of Table 7).

Moreover, the parallel pre-trends assumption holds for the outcome variables (except for one time-point in case of BCG) for the first phase eligible mothers in both LPS and HPS. Hence, allowing for the leniency that the second phase eligible mothers can face some spillover effects before actually starting with their benefits, these findings on the first phase eligibles give more strength to the causal inference. (See **Figure A.3** in **Appendix A**) It is quite plausible that the evolution of trends in the pre-intervention years become similar across the groups as they become more “balanced” through CEM.

6.3. Issue of differential trend of unobservable characteristics of the LPS and HPS

The central focus regions of the programme were the low-performing states, due to their poor performance on maternal and neonatal outcomes in the pre-intervention period. Therefore, one could argue that the roll-out of the programme, for example, the strategy and speed of roll-out of funding and other facilities, could have been different for the LPS compared to the HPS. That is, if the determinants of the programme implementation are systematically related to underlying trends in the institutional births in the LPS and HPS, one should be worried about differences in the characteristics of the two state-types that could potentially lead to meaningless/biased conclusion, as a state-fixed effect analysis would not merely take care of it.

³⁰One caveat regarding this approach is that it would not always provide at least one “exact match” *per se* in each of the treated sub-group with respect to the control group. To elucidate, since the matching would be done without taking into account the sub-groups of the *treated*, it is likely that there would not be a one-to-one matching for every observation in the control group with a corresponding one in a treated sub-group.

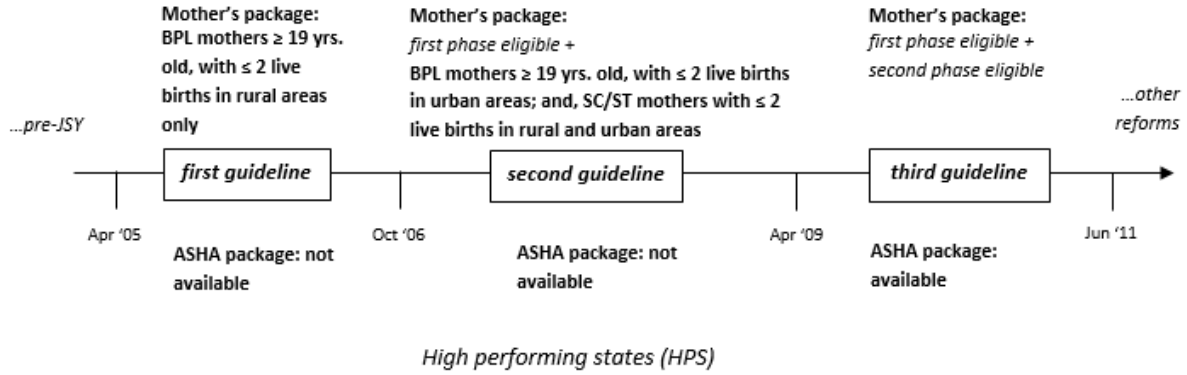
Table 7: Effects on the outcome variables after Coarsened Exact Matching

Dependent Variable:	(1) Institutional births	(2) ANCs	(3) Breastfeeding	(4) BCG
<i>First phase eligibles</i>				
Eligible without ASHA	0.016 (0.024)	0.017 (0.028)	0.012 (0.025)	0.062*** (0.025)
Eligible with ASHA	-0.024 (0.044)	-0.119*** (0.036)	-0.283*** (0.059)	-0.049* (0.030)
Eligible without ASHA*Post1	0.041 (0.032)	0.035 (0.041)	-0.007 (0.038)	-0.005 (0.038)
Eligible with ASHA*Post1	0.071*** (0.013)	0.098*** (0.020)	0.020 (0.015)	0.196*** (0.019)
<i>Second phase eligibles</i>				
Additional Eligible without ASHA	0.151** (0.064)	-0.017 (0.069)	-0.020 (0.065)	0.034 (0.055)
Additional Eligible with ASHA	-0.0003 (0.044)	-0.090*** (0.036)	-0.265*** (0.061)	0.021 (0.028)
Additional Eligible without ASHA*Post2	0.005 (0.155)	0.148 (0.094)	0.069 (0.131)	-0.023 (0.109)
Additional Eligible with ASHA*Post2	0.068*** (0.007)	0.030*** (0.008)	0.027*** (0.008)	0.053*** (0.007)
Constant	0.427*** (0.040)	0.716*** (0.049)	0.726*** (0.045)	0.641*** (0.045)
State FE	Yes	Yes	Yes	Yes
Birth year FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
<i>F-test of equality between interaction coefficients of first phase eligibles</i>				
<i>F</i> -statistic	0.77	1.89	0.44	21.96
<i>p</i> -value	0.381	0.170	0.508	0.000
<i>F-test of equality between interaction coefficients of second phase eligibles</i>				
<i>F</i> -statistic	0.17	1.56	0.11	0.48
<i>p</i> -value	0.684	0.212	0.743	0.489
Baseline mean of Ineligibles	0.250	0.796	0.426	0.878
Observations	227991	179062	215777	227991
<i>R</i> ²	0.119	0.256	0.169	0.123

Notes: (1) Sample contains observations ‘matched’ with CEM only. (2) The unit of observation is the mother who had her latest birth between 2001-08. (3) **EligiblewithoutASHA** and **EligiblewithASHA** denote the respective pre-intervention difference in means of the first phase eligible mothers in HPS and LPS with the control group (Ineligibles). **EligiblewithoutASHA*Post1** and **EligiblewithASHA*Post1** denote the respective difference-in-difference effect of the programme on the first phase eligible mothers in HPS and LPS. **Add.ElignlewithoutASHA** and **Add.ElignlewithASHA** denote the respective pre-intervention difference in means of the second phase eligible mothers in HPS and LPS with the control group (Ineligibles). **Add.ElignlewithoutASHA*Post2** and **Add.ElignlewithASHA*Post2** denote the respective difference-in-difference effect of the programme on the second phase eligible mothers in HPS and LPS. **Post1** and **Post2** denote the births taking place after the onset of first guideline (Apr 2005) and the ones after the onset of the second guideline (Oct 2006). (4) An *F*-test of equality between the coefficients **ElignlewithoutASHA*Post1** and **ElignlewithASHA*Post1** (i.e.the first phase eligibles) show that they are however, not significantly different from each other, except for the outcome variable on BCG. A similar *F*-test of equality between the coefficients **Add.ElignlewithoutASHA*Post2** and **Add.ElignlewithASHA*Post2** (i.e.the second phase eligibles) also show that they are not significantly different from each other. (5) Control variables include number of live births the mother has had, maximum schooling years of the mother, her religion, if her family belongs to one of the socially backward classes, the wealth quantile of her household, and some village-specific health infra-structure controls like presence of other child welfare programme in the village, distance to the nearest primary health centre, community health centre, to the nearest district hospital. (6) Standard errors clustered at district level within parentheses. (7) The unadjusted *R*² values are reported here. (8) The mean of the outcome variable in the control group (Ineligibles) in the pre-intervention period is reported. (9) ***, **, * implies $p < 0.01$, < 0.05 , < 0.10 respectively.

There are a few ways of dealing with this issue. Debnath (2018) deals with it by using districts on the border separating the geographically clustered LPS and HPS, in order to minimise the difference in characteristics. I, on the other hand, try to utilise the further spread of ASHAs in the HPS in consequence

Figure 6: Roll-out of JSY in the HPS



to a third revision to the JSY guideline. Thus, I study the eligible mothers only in the HPS who were exposed to the mother's cash transfer from the beginning of the intervention, and then also received an ASHA's guidance from April 2009 onwards.³¹ This analysis consolidates my results in three ways. (i) By only using the HPS sample, it avoids any systematic difference in the underlying trends of institutional births in the LPS and HPS that could have affected the implementation. (ii) It gives a more robust way of eliciting the ASHA's effect through comparison of mothers in the same state-type, than what is done in the original analysis by comparing the eligible mothers in LPS with that in HPS. (iii) Less number of eligible sub-groups makes it easier for the parallel pre-trends assumption to be validated.

Figure 6 briefly restates the revisions to the JSY guideline in the HPS. According to the first guideline, only the mother's package was introduced to the economically disadvantaged mothers who were at or above the age of 19 with up to two live births and belonging to below-poverty-line families in rural areas. In the second guideline, these eligibility criteria were relaxed to include an identical cohort from the urban areas; besides, mothers with up to two live births belonging to either of the two socially backward classes - *scheduled caste* and *scheduled tribe*, were also given the eligibility status. From April 2009, another revision, that is the third guideline, came into effect. Now, besides the mother's package that was already available to the eligible mothers, the ASHA was also introduced to guide the eligible mothers. In the following analysis, I will consider the timeline until May 2011 (afterwards, other health reforms were initiated and bridged with JSY).

³¹The information on the initiation of this phase is available from MOHFW (2009).

I consider the following DiD specification for estimation:

$$\begin{aligned}
Y_{ijt} = & \alpha + \beta_1 \text{Eligible}_{ij} + \beta_2 \text{AddEligible}_{ij} + \beta_3 (\text{Eligible}_{ij} * \text{Post1}_t) \\
& + \beta_4 (\text{AddEligible}_{ij} * \text{Post2}_t) + \beta_5 (\text{Eligible}_{ij} * \text{Post3}_t) + \beta_6 (\text{AddEligible}_{ij} * \text{Post3}_t) \\
& + X'_{ij} \delta + \mu_t + \gamma_j + \epsilon_{ijt} \quad (4)
\end{aligned}$$

Y_{ijt} is the outcome variable of the mother i in some HP state j giving her latest birth in year t . Eligible_{ij} is the treatment group which takes value 1 for the mother who was eligible for cash assistance in an HPS as per the first guideline. AddEligible_{ij} is another treatment group that takes value 1 for the additional mothers who were not eligible for the cash assistance in the first phase but became so in the second phase. Post1_t captures the time window between April 2005 - March 2009 and takes value 1 for all the births that took place during this time. Essentially, an interaction of Eligible_{ij} with Post1_t should give the treatment effect of only the mother's cash transfer on the mothers who became eligible according to the first guideline. Similarly, Post2_t captures the time window between October 2006 - March 2009 and takes value 1 for all the births that took place then. The interaction of AddEligible_{ij} with Post2_t should give the treatment effect of only the mother's cash transfer on the mothers who became eligible for it only after the second guideline took effect. Finally, Post3_t is a dummy variable for the births from April 2009 onwards, when all eligible mothers received the ASHA's counselling besides cash assistance. From the respective interactions of Post3_t with the two treatment groups, we would get the combined effect of the mother's cash transfer and the ASHA's guidance for each of the groups. Thus, the coefficients of interest here would be $\beta_3, \beta_4, \beta_5$ and β_6 . Comparison between β_5 and β_3 would give an idea of the additional effect of having the ASHA's counselling for the first phase eligible mothers. In the same way, a comparison between β_6 and β_4 would indicate the same for the additional eligible mothers of the second phase. The remaining notations of the equation indicate the same as in Equation (1).

The estimates reported in **Table 8** suggest that the effect of the mother's cash assistance on all outcome variables is more prominent in magnitude for the first phase eligible mothers than that for the second phase eligible mothers (all differences in effects being statistically significant at 1%, except breastfeeding). This bigger *average treatment effect* (ATE) could also be due to the fact that the first phase eligibles are exposed to the benefits for a longer period than the second phase eligibles. The results after the third guideline took effect, is, however, more nuanced. The first phase eligible mothers show a substantially large difference in effect in institutional births and ANC's in the period when both mother's cash transfer and ASHA are available. On the contrary, the ATE on the second phase eligible mothers remains more or less similar in both Post2 and Post3 , thus implying that an additional presence of ASHA did not provide any value-added in affecting their institutional birth rates and ANC's. In the case of BCG vaccination, the first phase mothers still experience a statistically significant positive effect, but the effect on the second phase mothers become quite small and also imprecise. On early breastfeeding, I find no precise effect of the mother's incentive

on the eligible mothers of both phases. This complements the earlier findings on early breastfeeding in the main analysis, where too, I see that the eligible mothers in HPS do not benefit significantly from the mother’s package in early breastfeeding practices. Finally, with the introduction of ASHAs in the HPS, there is no change in effect either. When it comes to the robustness of the results in this section, the first phase eligible mothers in the HPS (according to Equation (4)) show clear parallel pre-trends in all the outcome variables in the baseline years, with respect to the ineligible mothers. The second phase eligible mothers, however, experience some spillover effects already before attaining eligibility in late-2006 (See **Figure A.4** in **Appendix A**).

Therefore, to sum up, the takeaway from this analysis is that with the ASHA by their side, the mothers eligible according to the first guideline experienced a bigger increase in case of institutional births and ANC take-ups; however, the effect on breastfeeding and BCG vaccination subsided with the introduction of ASHAs (the finding on breastfeeding being only suggestive). On the other hand, the mothers eligible according to the second guideline did not experience any additional positive effect with the introduction of ASHAs. Note that the first phase mothers in the HPS consist of mothers who are below-poverty-line, with less than two live births, and living in rural areas. They have been discussed as a vulnerable group earlier in this paper, and as per the main findings of Section 5, they seem to benefit more from the ASHA’s guidance. Even in the analysis with the HPS sample only, this particular group seems to improve substantially in their outcomes after ASHA is introduced. This last finding, however, holds for only institutional births and ANC uptakes.

Now at this point, some caveats should be borne in mind. Before comparing the original findings of Section 5 with the findings here, it is important to stress that this analysis with only the HPS serves as an extension rather than a replication of the previous findings. It is because, when we look at the analysis with the high-performing states only, the empirical model changes by a large extent, with the number of treatment categories being reduced to *Eligible* and *Additional Eligible* and the control group of *Ineligible*. Essentially, the $Eligible_{ij}$ of Equation (4) is equivalent to $EligiblewithoutASHA_{ij}$ of Equation (1) and $AddEligible_{ij}$ of Equation (4) is equivalent to $AddEligiblewithoutASHA_{ij}$ of Equation (1). Moreover, since $Post1_t$ and $Post2_t$ vary in time-frame in the two equations, in addition to the presence of other variables, one cannot expect effects of similar magnitude in the two corresponding analyses.

On a final note, the mixed findings on the ASHA’s effect in the analysis with HPS only, also makes one curious about how the ASHA’s incentive was paid out. Increased effects in the pre-birth outcomes (institutional births and ANC check-ups) and reduced effects in the post-birth outcome (BCG vaccinations) raise questions on certain possibilities. Did the ASHA’s full payment come directly during the birth with no direct incentives for postnatal care? Or, was the first payment (full/instalment) delayed so much so that the ASHA felt less incentivised to carry on with her postnatal services? Unfortunately, the guidelines do not clearly state how the ASHA’s incentive was disbursed after their introduction in HPS, and as a result, these questions remain beyond the scope of investigation.

Table 8: Effects on the outcome variables in HPS only

	(1)	(2)	(3)	(4)
Dependent variable:	Institutional births	ANCs	Breastfeeding	BCG
<i>First phase eligibles</i>				
Eligible	-0.103*** (0.010)	-0.057*** (0.017)	0.008 (0.014)	-0.039*** (0.015)
Eligible*Post1	0.098*** (0.013)	0.066*** (0.020)	0.023 (0.018)	0.119*** (0.017)
Eligible*Post3	0.218*** (0.019)	0.179*** (0.019)	0.021 (0.021)	0.098*** (0.019)
<i>Second phase eligibles</i>				
Additional Eligible	0.024*** (0.007)	-0.032*** (0.006)	0.009 (0.007)	0.012** (0.005)
Additional Eligible*Post2	0.054*** (0.008)	0.053*** (0.009)	0.015 (0.009)	0.036*** (0.006)
Additional Eligible*Post3	0.050*** (0.011)	0.052*** (0.007)	-0.010 (0.012)	0.003 (0.007)
Constant	0.411*** (0.040)	0.368*** (0.030)	0.355*** (0.039)	0.739*** (0.025)
State FE	Yes	Yes	Yes	Yes
Birth year FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
<i>F-test of equality between the coefficients of Eligible*Post1 & Eligible*Post3</i>				
<i>F</i> -statistic	35.87	89.09	0.01	3.99
<i>p</i> -value	0.000	0.000	0.934	0.045
<i>F-test of equality between the coefficients of Add.Eligible*Post2 & Add.Eligible*Post3</i>				
<i>F</i> -statistic	0.08	0.05	5.27	18.98
<i>p</i> -value	0.780	0.828	0.023	0.000
Baseline mean of Ineligibles	0.284	0.582	0.479	0.890
Observations	146085	128227	140143	146085
R^2	0.068	0.447	0.111	0.067

Notes: (1) Sample contains observations from HPS only (2) The unit of observation is the mother in HPS, who had her latest birth between 2001- May 2011. (3) **Eligible** denotes the pre-intervention difference in means of the first phase eligible mothers with the control group (Ineligibles). **Additional Eligible** denotes the pre-intervention difference in means of the second phase eligible mothers with the control group (Ineligibles). **Eligible*Post1** and **Additional Eligible*Post2** denote the respective difference-in-difference effect of the mother's incentive only on the first phase and second phase eligible mothers respectively. **Eligible*Post3** and **Additional Eligible*Post3** denote the respective difference-in-difference effect of the mother's incentive and ASHA's presence on the first phase and second phase eligible mothers respectively. **Post1** denotes the births taking place between Apr 2005-Mar 2009, **Post2** denotes the births taking place between Oct 2006-Mar 2009, and **Post3** denotes the births taking place between Apr 2009-May 2011. (4) An *F*-test of equality between the coefficients **Eligible*Post1** and **Eligible*Post3** (i.e.the DiD effect on first phase eligibles with one package and with two packages) show that they are significantly different from each other for all variables except early breastfeeding. A similar *F*-test of equality between the coefficients **Add.Eligible*Post2** and **Add.Eligible*Post3** (i.e.the DiD effect on second phase eligibles with one package and with two packages) show that they are significantly different from each other only for early breastfeeding and BCG. (5) Control variables include number of live births the mother has had, maximum schooling years of the mother, her religion, if her family belongs to one of the socially backward classes, the wealth quantile of her household, and some village-specific health infra-structure controls like presence of other child welfare programme in the village, distance to the nearest primary health centre, community health centre, to the nearest district hospital. (6) Standard errors clustered at district level within parentheses. (7) The unadjusted R^2 values are reported here. (8) The mean of the outcome variable in the control group (Ineligibles) in the pre-intervention period is reported. (9) ***, **, * implies $p < 0.01$, < 0.05 , < 0.10 respectively.

7. Discussion and Conclusion

This study investigates a CCT programme at the national level in India, which had a unique feature of incentivising both the demand end and the supply end of maternal and child healthcare in the country. The poor rates of maternal mortality and neonatal mortality in the country expedited the need for an intervention

like this. Multiple factors contributed to these poor statistics. Often poor mothers, living in remote villages, would require to travel long distances in order to avail proper healthcare facilities; hence they would instead choose to give birth at home and/or in the absence of skilled supervision. Besides the indirect costs due to transportation of the expecting mother in labour and other accompanying family members, another cost that would usually arise is the opportunity cost of lost wages of the family member(s) who have to remain by the side of the mother at the hospital for one or more days. To minimise these costs, the JSY programme allowed for one-time cash assistance to mothers if they chose to give birth at public healthcare facilities under the supervision of trained personnel. A performance-based pay was to be given to trained health workers, called ASHAs, appointed by the programme if they helped the expecting mothers in the community during pregnancy, birth and postnatal phase.

Though it was a national programme, there was heterogeneity in terms of eligibility of the mothers entitled to cash benefits and that depended on her social and economic status, caste, residence and number of births. At the same time, there was the heterogeneous implementation of the health-workers as well, across states, i.e. the low-performing states and the high-performing states. I exploit these two variations in the programme implementation and try to understand through a difference-in-difference identification strategy as to whether the mother's incentive or the ASHA's incentive plays a more significant role in several outcomes related to maternal and neonatal health. Though I do not check the direct effects on maternal and neonatal mortality rates (which led to the introduction of the programme in the first place), I do check the direct effects on the factors that affect those mortality rates, for example, birth at public health facilities, required number of ANC check-ups, early breastfeeding practices and BCG vaccination. More importantly, these four outcomes of interest are also the ones on which the cash transfers to the mother or the ASHA were conditional. Therefore, in a short-run analysis, these outcomes should experience the most immediate effects, if any. Nevertheless, I agree that it is equally important to look into the bigger picture as well, that is, whether there was a substantial change in the mortality rates eventually.

The current literature is quite consolidated with findings related to the overall impact of JSY on several maternal and child health outcomes; but, what the literature lacks is that no study has so far tried to distinguish the effects of these two types of incentives of the programme structure. Debnath (2018) gets the closest to this issue; he uses the variation in the pay scale to the mother *vis-à-vis* the ASHA to study the degree of impact each had on the healthcare utilisation. I, on the other hand, try to account for all the intricacies in the implementation of the programme in its initial years and investigate the differential effects of the mother's eligibility for the cash benefits and the ASHA's presence on these outcomes.

The most important result of this study shows that the mothers eligible for both the mother's incentive and the ASHA's help, experienced a bigger positive effect in institutional births and early breastfeeding than the mothers with mother's incentive only. This result is statistically significant. While this could qualify as causal evidence for the first phase eligible mothers of the programme (through the presence of clean parallel pre-trends in institutional births and breastfeeding practices), it is hard to confirm that the effect on the

eligibles of the latter phase was also causal, due to possible spillover effects of a programme as big as this. I further find evidence that eligible mothers receiving cash benefits as well as the ASHA's guidance showed bigger improvement in receiving the recommended three antenatal care check-ups and also in having their newborns vaccinated with BCG. In contrast, the mothers getting just the cash assistance showed relatively small or no effect. Although the findings on the ANC utilisation and BCG vaccination could not be confirmed as causal evidence with the original sample, due to differential evolution of trends with the control group, a CEM-refined sample validates the evidence on ANC as causal.

To offer a better conclusion on the channel of ASHA's effect, I restrict the sample to only rural mothers (and with up to two births). This analysis with more homogenised groups minimises the possible bias in inference which could arise from differential selection. At the same time, it also makes the groups of first phase eligible mothers in LPS and HPS demographically identical. While it is a plausible argument that comparing the LPS and HPS mothers to pin down the ASHA's effect could be flawed due to many systematic differences, trying to homogenise the two groups across their demographic indicators could offer some strength to the comparison. It is to be noted that when I analyse only the sub-sample of rural mothers, the first phase eligible mothers in both LPS and HPS are above 19 years old, with less than two live births, belonging to below-poverty-line households in rural areas. Compared to the control group of ineligible mothers (who are a mix of either above-poverty-line, or below-poverty-line but less than 19, or not belonging to socially disadvantaged castes, or with more than two births, in rural HPS), the first phase eligible mothers in HPS see a small or no effect with only the mother's cash assistance. In contrast, the first phase eligible mothers in the LPS see a large effect with the cash assistance and the ASHA's guidance. Given the eligible mothers of the first phase in the rural areas are the most vulnerable ones, irrespective of being in LPS or HPS, they are likely to benefit in the same way from the cash assistance. However, deducing from the findings of the HPS cohort, only the cash incentive to the mother does not suffice. A similar outcome persists when I further constrict the sample to rural mothers with up to two live births. Restricting the sample in this way also makes the control group more comparable to the groups of first phase eligible mothers in both LPS and HPS. Therefore, one can conclude that at least for the rural sub-sample (with less than two births) the programme's effect is coming through the ASHA's performance.

In a similar exercise, where I get the sample homogenised through coarsened exact matching, the treatment effect on the eligible mothers in the LPS remains robust while that on the eligible mothers in HPS becomes imprecise. This finding also does not reject the possibility that only a mother's incentive does not improve the health outcomes. Then it becomes all the more plausible that the effect seen in the LPS occurs through the ASHA's channel.

Another scrutiny with only the HPS sample (who were introduced to ASHAs from 2009 onwards), however, shows that the added effect of the ASHAs can be seen only in case of institutional births and ANC take-ups by the first phase eligible mothers in the HPS. This finding reconciles with the previous findings on rural mothers in general. The fact that in the HPS analysis, the first phase eligible mothers (i.e. the

rural mothers above 19 with up to two births and belonging to below-poverty-line households) showed more improvement in these two outcomes, after the introduction of ASHAs post-2009, mirrors the conclusion from the other analyses on ASHA's superior effect on such mothers.

Finally, concerning the nuances in the interpretation of the results, one needs to practise caution when claiming that the better effect can only be offered through the presence of the ASHAs, and hence incentivising the supply-side (here, the ASHA) would offer a better solution. In this paper, I compare the eligible mothers in the low-performing and high-performing states in the most characteristically homogenised way possible, in order to confidently deduce that the additional effect found in the LPS must come through the presence of ASHA. However, this study's set-up allows having this homogenisation possible for only the rural sample (with up to two births) of the first phase mothers across the LPS and HPS.³² Therefore, the sole effect of ASHA can be pinned down in so far as these mothers are concerned. Undoubtedly these mothers - below-poverty-line and above 19, rural and with less than two births - were the main focus group of the programme (i.e. those who became eligible at the very first phase), and this analysis is able to point out that the ASHA's channel is a better way of improving their outcome. However, the above inference is based on the assumption that these vulnerable mothers are likely to behave alike across the two state-types. In the worst case, there could still be a possibility that LPS being historically the worse performer and thus the mothers there being the "most needy" of the intervention, simply react stronger to having both the packages. Thus, there remains some possibility that the effect we see in the low-performing states, in general, is due to the complementarity of the mother's package and the ASHA package, and the effect may not be entirely the same had there been only the ASHA. Here lies the classic limitation of quasi-experimental studies, because they do not necessarily provide a clear counterfactual. Nevertheless, it is safe to conclude here that cash benefits to mothers for giving birth at public health facilities under skilled supervision might not be sufficient to motivate her (or, to overcome the costs). A mother needs frequent counselling and guidance pre and post-birth by the health worker in the community, to attain all-round health improvement of herself and the newborn.

On a final note, from the public policy perspective, it is vital to assess the cost-effectiveness of the packages. We must remember that employing the ASHA package in addition to the mother's package comes with additional costs in the public healthcare sector. Therefore, I compare the first phase eligible mothers in the HPS and the first phase eligible mothers in the rural LPS to determine how cost-effective it was.³³ I find that for 1 pp. increase in institutional birth rate compared to pre-intervention, 45926.99 INR (the mother's package cost times the number of births) was spent in HPS. In contrast, that corresponding cost was 2483000 INR in the rural LPS with the dual package. The latter expenditure is about four times that spent in the former, with the first phase mothers. However, then again, the number of eligible mothers in

³²Trying to minimise further the groups with more specific characteristics (e.g. only below-poverty-line or only below 19 years) often results in the omission of some treatment groups due to multicollinearity in the analysis, given that some of the groups are already formed with precise specifications.

³³I compare the eligibles only from rural LPS because the eligibles from the HPS were only from the rural areas in the first phase. Therefore, I intend to keep the comparison groups as homogeneous as possible.

the rural LPS is about five times of that in HPS, so the dual package in rural LPS was more cost-effective even if we are looking at only institutional birth rates. Needless to say, the additional gains of ASHA is also present in the antenatal and postnatal outcomes and in general, overall healthy lifestyle.

8. References

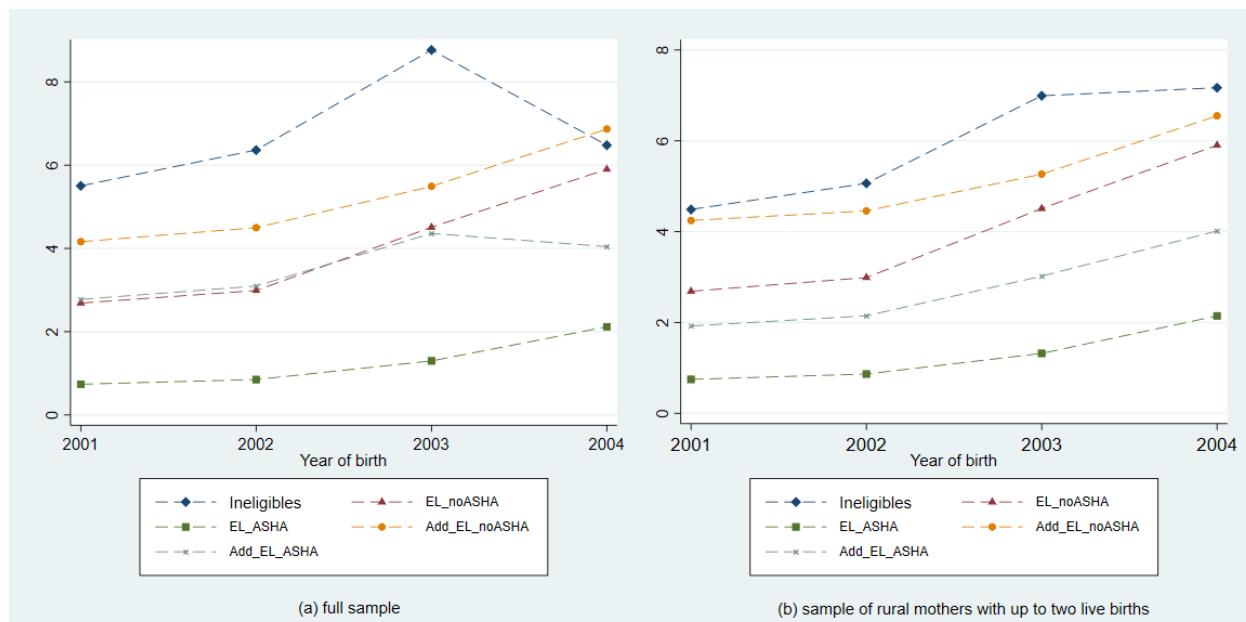
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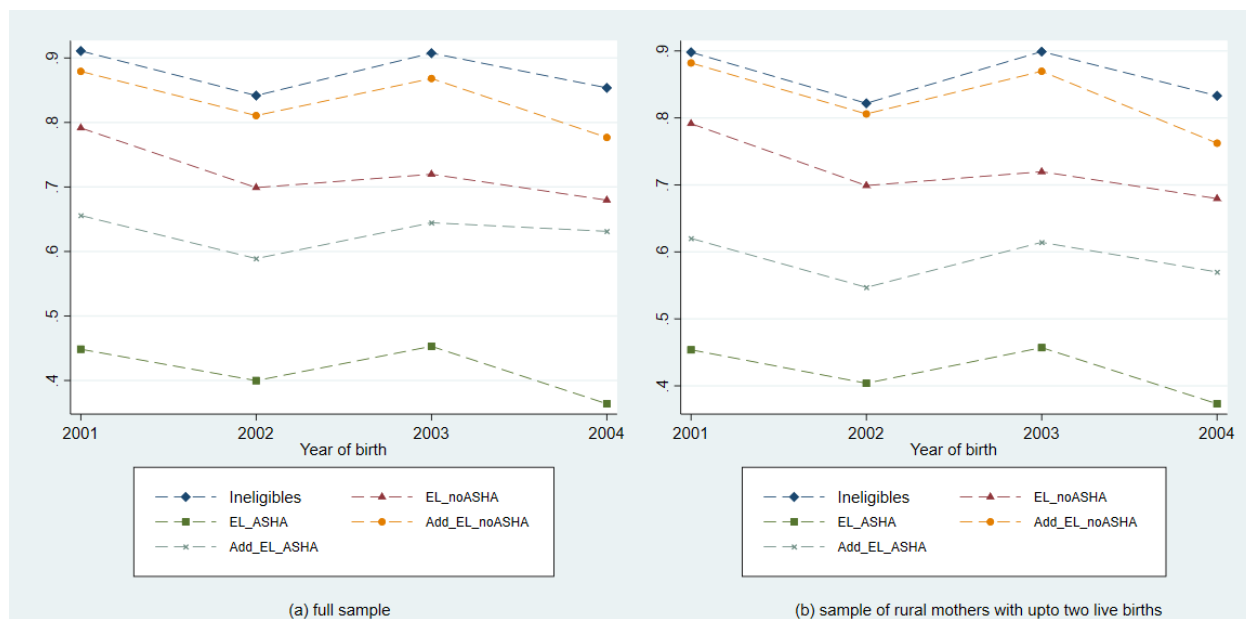
Appendix A.

Figure A.1: Raw trends in Antenatal care in the pre-intervention years



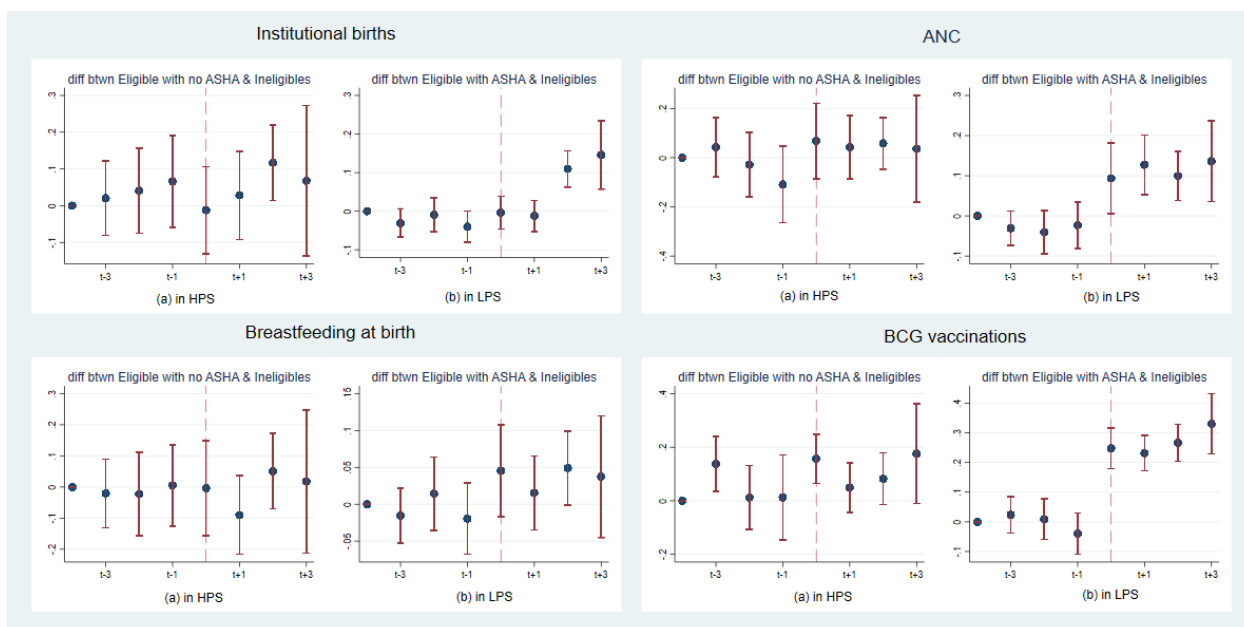
Notes: The first plot (a) in the graph is for the full sample of mothers who had their most recent birth in 2001-04. The second plot (b) is for the rural mothers with less than two live births, who had their recent birth in 2001-04.

Figure A.2: Raw trends in BCG vaccination in the pre-intervention years



Notes: The first plot (a) in the graph is for the full sample of mothers who had their most recent birth in 2001-04. The second plot (b) is for the rural mothers with less than two live births, who had their recent birth in 2001-04.

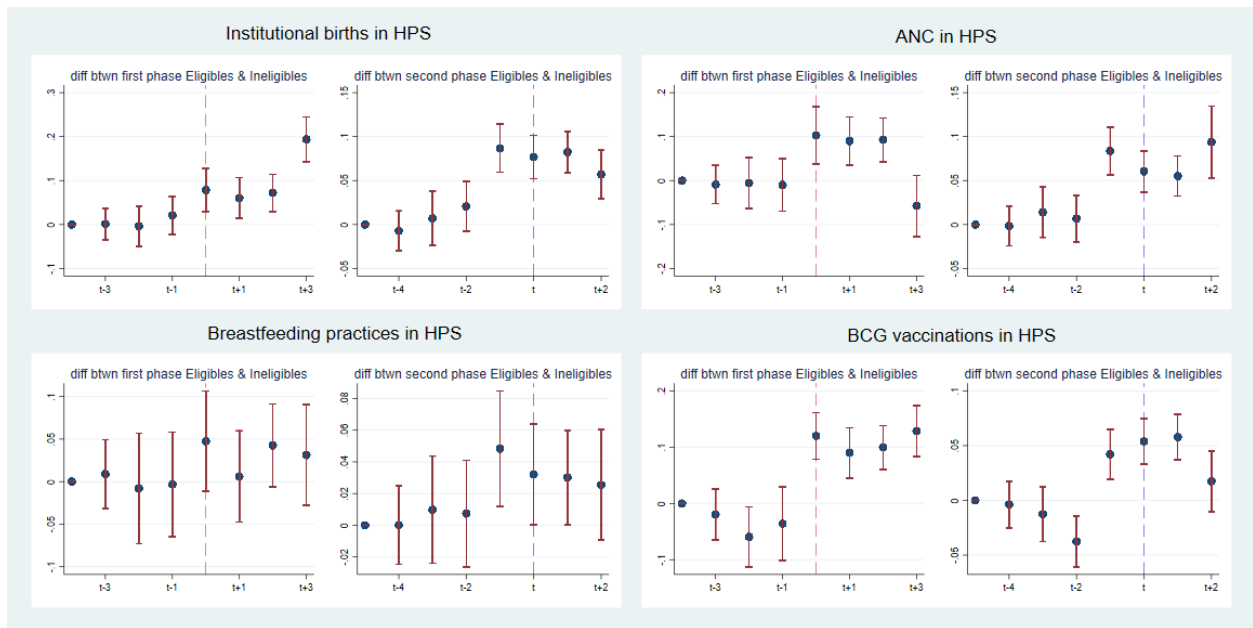
Figure A.3: Time-varying difference in the outcome variables between the first-phase treatment groups and control group - with CEM sample



Notes: The sample used for this graph contains observations ‘matched’ with CEM only. This graph summarises for each outcome variable the difference between the first phase eligible mothers in HPS (without ASHA) and the control group in (a), and the difference between the first phase eligible mothers in LPS (with ASHA) and the control group in (b). The timeline spans from 2001-08 and the onset of the intervention is shown at t=2005. The parallel pre-trends assumption holds for the first phase eligible mothers both in LPS and HPS in case of all outcome variables (except for one relatively earlier time point in HPS for BCG)

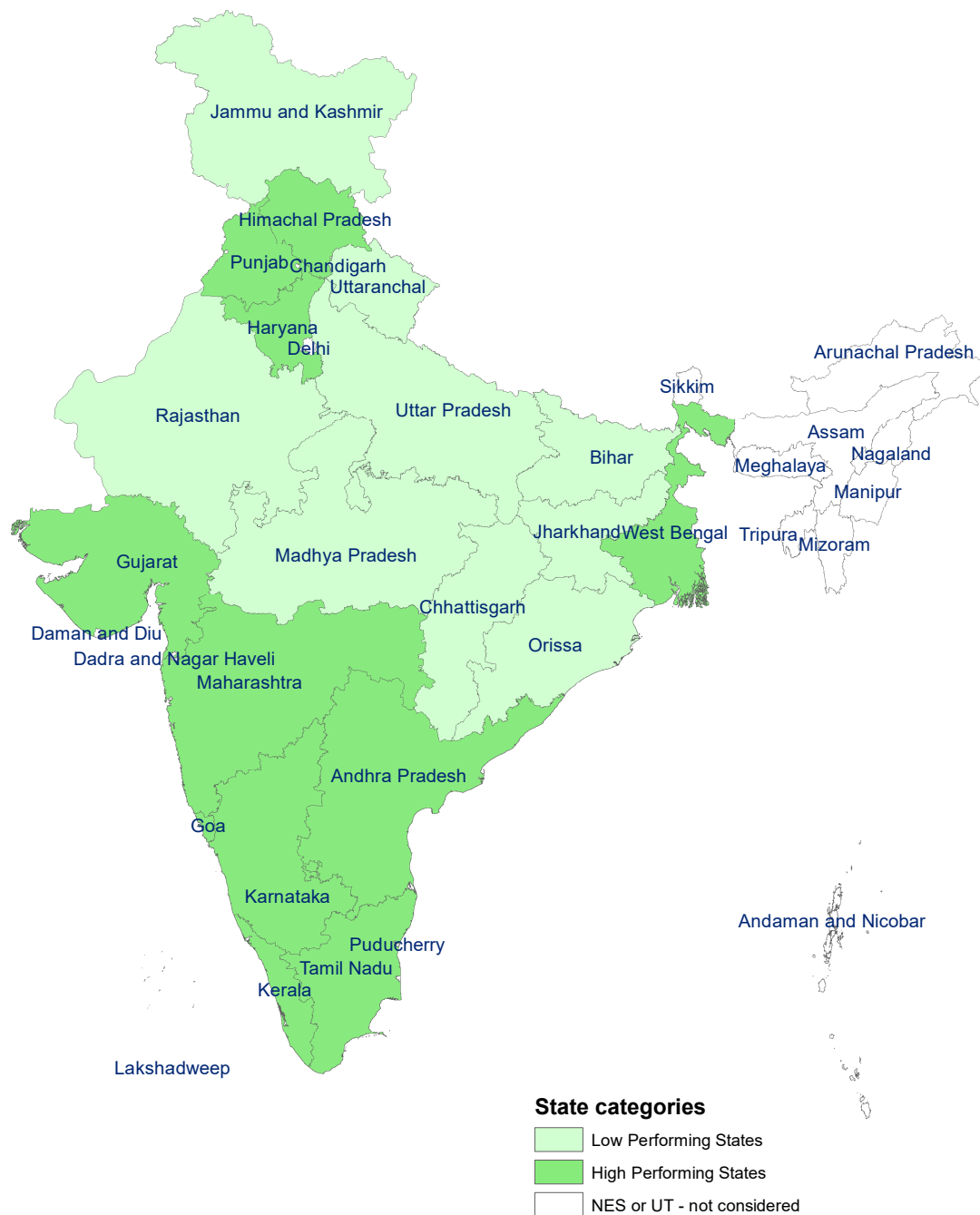
Appendix B.

Figure A.4: Time-varying difference in the outcomes variables between the treatment groups and control group in HPS only



Notes: This graph summarises for each outcome variable the difference between the first phase eligible mothers with the control group, and the difference between the second phase eligible mothers with the control group in HPS. The timeline spans from 2001-08 and the onset of the intervention is at t=2005 for first phase and t=2006 for second phase. The parallel pre-trends assumption holds for the first phase eligible mothers in case of all outcome variables.

Figure B.1: Categorisation of the low and high-performing states in India according to JSY programme



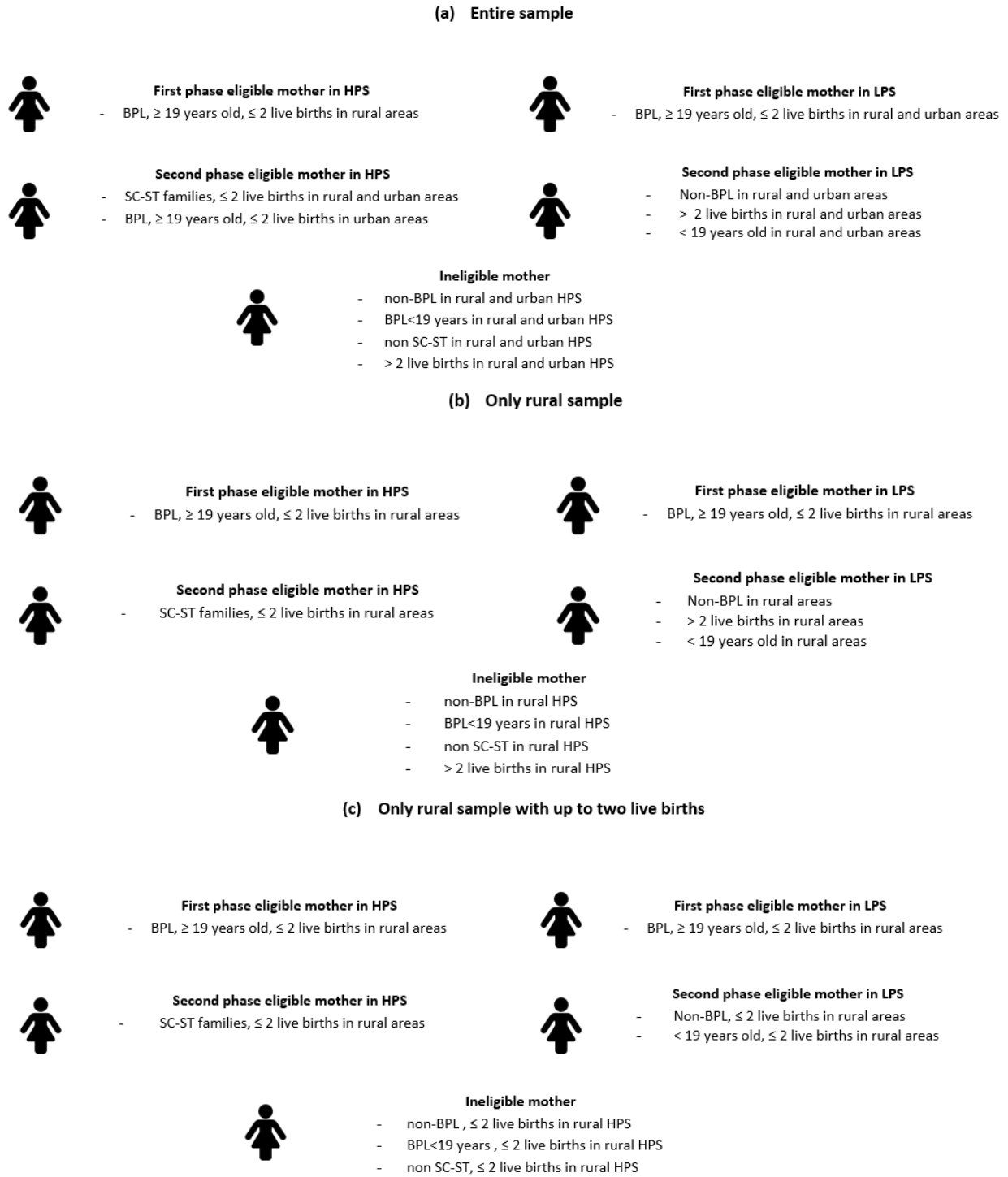
Notes: This is a representation of the low and high-performing states according to the JSY programme. Note, the North-Eastern States (NES) and the Union Territories (UTs) are left out of the categorisation as they are not included in this study. The political map of India is according to Census Data 2001.

Figure B.2: Distribution of institutional birth rate across states in the time period 2001-04



Notes: This is a dot density plot of average institutional birth rate across the states between 2001-04. Each dot in the graph implies 1 institutional birth per 1000 births. The political map of India is according to Census Data 2001.

Figure B.3: Composition of the treatment groups



Notes: This is a representation of each group's composition used in the empirical analysis of Section 4.2 and the results in Section 5. Figure (a) describes the groups when the entire sample is used, Figure (b) describes the groups when only the rural sample is used, and Figure (c) describes the corresponding groups for rural mothers with up to two live births. Note that under all cases, the eligible groups in LPS had further guidance from ASHA while the eligible groups in HPS did not.

Figure B.4: JSY programme details - the first two guidelines

	Low Performing States		High Performing States	
First set of guidelines: April 2005- October 2006				
Eligibility of mothers	- pregnant women (≥ 19 y.o), belonging to BPL families and choosing to deliver in public health facilities; - Upto 2 live births - Both in rural and urban areas		- pregnant women (≥ 19 y.o), belonging to BPL families and choosing to deliver in public health facilities; - Upto 2 live births - Only in rural areas	
ASHAs	Available		Not available	
Scale of assistance	Rural	Urban	Rural	Urban
	Mother's package: 700 INR	Mother's package: 600 INR	Mother's package: 700 INR	Mother's package: N/A
	ASHA's package: 600 INR	ASHA's package: 200 INR	ASHA's package: N/A	ASHA's package: N/A
Second set of guidelines: October 2006- end of 2008				
Eligibility of mothers	- All pregnant women choosing to deliver in public health facilities; - No limit on no. of births - In rural and urban areas		- Only BPL women (≥ 19 y.o) and SC/ST women choosing to deliver in public health facilities; - Upto 2 live births; - In rural and urban areas	
ASHAs	Available		Not available	
Scale of assistance	Rural	Urban	Rural	Urban
	Mother's package: 1400 INR	Mother's package: 1000 INR	Mother's package: 700 INR	Mother's package: 600 INR
	ASHA's package: 600 INR	ASHA's package: 200 INR	ASHA's package: N/A	ASHA's package: N/A

Notes: This is a detailed representation of the eligibilities of the new mothers for the mother's package and the ASHA's package according to the first two guidelines.

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