IMPACT OF FINANCIAL INCENTIVES, AWARENESS, AND ACCESS TO HEALTH FACILITIES ON MORTALITY AND HEALTH SERVICES UTILIZATION:

EVIDENCE FROM INDIA'S NATIONAL RURAL HEALTH MISSION (NRHM)

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Abstract

This thesis evaluates the health effects of the National Rural Health Mission (NRHM) of India. The program was launched in April 2005 and included three components of information provision through local health workers, financial incentives for institutional delivery and expansion of physical health care infrastructure. The study uses three rounds of individual and household level microdata and one round of facility survey from the District Level Health Survey (DLHS) published by Ministry of Health and Family Welfare (MoHFW) and the Annual Health Survey (AHS) from the Registrar General of India (Ministry of Home Affairs). The empirical design exploits variation in coverage at the district level to assess impacts on child mortality, health services utilization and breastfeeding. There is no evidence of differential trends by future coverage before the implementation of the program. Results suggest that information provision, financial incentives for institutional delivery and physical infrastructure expansion reduce infant, neonatal and one-day mortality. There is also some evidence of increased take-up of health facility services. Mortality reduction through financial incentives has not been credibly documented in the extant literature. The thesis also provides some of the first evidence on mortality reduction through increased information provision by local health activists in the Indian context. The study finds increased physical health infrastructure coverage leads to increased take-up of health facility services in the form of increased skilled birth attendance, health facility birth, and breastfeeding in the initial hours after birth. Examining the role of gender, the study finds that the impact on health outcomes of boys tend to be larger for coverage on financial incentive and awareness. The interaction effects show that financial incentive for health facility birth and health facility availability are working as substitutes.

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Dedicated to my daughter Anika

and wife Puja

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Abbreviations

AHS:	Annual Health Survey
ANC:	Ante Natal Check-ups
ASHA:	Accredited Social Health Activist
BPL:	Below Poverty Line
DLHS:	District Level Health Survey
HPS:	High Performing States
IIPS:	International Institute for Population Studies
JSY:	Janani Surakshya Yojana
LPS:	Low Performing States
MHA:	Ministry of Home Affairs
MoHFW:	Ministry of Health and Family Welfare
NGO:	Non-Governmental Organization
NHM:	National Health Mission
NRHM:	National Rural Health Mission
NUHM:	National Urban Health Mission
RGI:	Registrar General of India
SBA:	Skilled Birth Attendance
SC:	Scheduled Caste
SC:	Sub-Centre
ST:	Scheduled Tribe
UTs:	Union Territories

Chapter 1

Introduction

1.1. The rationale of the study

With the beginning of the millennium of the 2000s, the leaders from around the world resolved to end the scourge of poverty and other monitored targets to be achieved by the year 2015. Out of the eight United Nations Millennium Developmental Goals (MDGs), three were directly related health issues such as to reduce child mortality, to improve maternal health and to combat HIV/AIDS, malaria, and other diseases. As such health issues have to be prioritized in countries around the world especially in developing and the Least Developed Countries (LDCs).[1] India's, being a signatory, is committed to the MDGs and has aligned its developmental policies to achieve them in a time-bound manner. The progress of India has been mixed in achieving these MDG targets. On the issues of reducing poverty by half, as per the official estimates, it has achieved the same. However, hunger deaths still happening in India. Similarly, while it has achieved gender parity in primary school enrollment, target pertaining to primary school enrollment itself and completion of primary schooling still remains to be achieved. With regard to clean drinking water, there has been some progress. But, a lot remains to be done in the area of sanitation. On the important issues of health and disease, India has witnessed moderate progress with regard to reducing by 2/3rd mortality among children under five (U5MR), which has fallen from 125 per 1000 live births in 1990 to 49 per 1000 live births in 2013

[1] By December, 2018, according to the United Nations, there are about 47 LDCs which includes countries like Bangladesh, Nepal and Bhutan. Available at https://www.un.org/development/desa/dpad/wp-content/uploads/sites/45/publication/ldc_list.pdf, accessed on 10th July 2019.

(MDG Goal 4 target is 42 per 1000 live births). This decline is primarily attributed to the progress India has made in terms of infant mortality (i.e. death within one year of birth) and neonatal mortality (death during the first 28 days of birth). Goal 5 of MDG on improving maternal health, India has achieved a Maternal Mortality Rate (measured per 100,000 live births) of 130 in 2014-16 (target being 139 by 2015).[2] UNDP attributes such improvement to an increase in institutional delivery and increase in deliveries attended by skilled birth personnel to the Janani Suraksha Yojana (JSY). During the period between 1992-93 and 2009, the institutional facility has gone up from 26 percent to 72 percent and skilled birth personnel attended deliveries percentage shot up from 33 percent to 76 percent during the same period. Thus, it can be seen that there is still a lot of unfinished agenda as per MDGs, which is carried forward to the sustainable developmental goals (SDGs).[3]

Child and maternal mortality is on a decline but still high in India. It is true that the mortality rates like the infant and neonatal mortality are declining over the years but as compared to neighboring countries like Nepal and Bangladesh it is still sluggish (Table A 1.1). In the year 2000, India had an Infant mortality rate of 66.7 per 1000 live birth which was higher than Bangladesh (64) and Nepal (60.2). The low & middle-income countries also had a lower infant mortality rate at 58.8. In terms of neo-natal mortality also these countries performed better than India. Sub-Saharan Africa had neonatal mortality of 40.7 in 2000 as compared to 45.1 of India. The comparison is limited to

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[2] Niti Aayog, available at https://niti.gov.in/content/maternal-mortality-ratio-mmr-100000-live-births, accessed on 10th July 2019.

[3] UNDP, available at: http://www.in.undp.org/content/india/en/home/post-2015/mdgoverview.html, accessed on 10th July 2019.

showing similarly placed or even worse off countries in terms of income have better health indicators. However, in terms of maternal mortality rate, India's performance is better than the countries of Bangladesh, Nepal and even better than the average of South-Asian and low & middle-income countries (Table A 1.1). But, these are aggregate mortality figures which mask the stark differentials in the mortality outcomes by residence. The rural mortality figures are twice as large as the urban areas (Table A 1.2). The mortality outcomes also differ with social groupings, the socially disadvantaged groups (SCs/STs/OBCs) showing higher child mortality as compared to others. Most developing countries including India are faced with the problem of improving the quality of public health care facility available to all to keep up with the spirit of the 'Alma-Ata declaration' of 1978 that identified primary health care as the key to "Health for All". Provisioning of quality health care facility is crucial for the natal care which can directly affect mortality outcomes. It has been found that better primary health care system leads to a significant reduction in mortality in countries like Sri Lanka, Vietnam, and Thailand. Rohde et. al. (2008) found that these countries witnessed a 5% reduction in under-five mortality during 1990 and 2006. However, there are still huge gaps in the access to primary health care facilities in most of the developing countries and it becomes stark with increasing poverty levels (Bhutta, Z.A. et. al, 2010).

UNICEF in its *State of Asia-Pacific's Children* (2008) reported that the largest absolute number of newborn deaths in the world occurs in South Asia and India contributed around one-quarter of this! One of the key areas which need to be addressed is to increase the provisioning of funds as a percentage of GDP. As of now, the public expenditure on health as a percentage of GDP is stagnant. India's total health expenditure as a percent of GDP has come down to 3.6 percent in 2016 from 4 percent in 2000. On the other hand, in developed countries like the United Kingdom (UK) and the United States of America (USA), the health expenditure has been increasing over the years and in 2016 it recorded 9.8 percent and 17.1 percent, respectively (Table A 1.3). Further, public health expenditure in India in 2017-18 (BE) (as a percentage of GDP) was only 1.4 percent and has hovered around the 1-1.5% mark during the last five years. In the year 2016-17 (RE), the government expenditure on health in India is estimated to be 26.7% of total health expenditure. This portrays the relative dire situation of the health sector in terms of funding as a percentage of GDP.[4] Despite constitutional provision and various judgments by the apex court of country i.e. Supreme Court of India, the political discourse on health issues has hardly taken center stage.[5] However, the silver lining seems to be the recent National Health Policy (NHP-2017) which proposes to raise public health expenditure progressively to 2.5% of the GDP by 2025.

The National Rural Health Mission (NRHM) was born in this background of stagnant public health expenditure and to the commitment under United Nations to meet the targeted MDGs especially in the areas of MDG Goal 4 (child mortality) and MDG Goal 5 (improve maternal health).

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[4] Though funding of national level health programmes has increased but overall all health expenditure as a percentage of GDP has remained more or less constant.

[5] The constitution puts public health as a state subject and family welfare at concurrent subject (i.e. subject on which both central and state government can legislate)[5]. Both, the central as well as the state government has an obligation to improve the state of health status of the country under various articles of Constitution of India. Directive principles of state policy (DPSP) provided in Part IV of the Constitution of India has various provisions that mandates the government of the day to strive for better provisioning of the health facilities and care to each and every person living within the geographical territory of the country.

1.2 The birth of the National Rural Health Mission (NRHM)

The events that lead to the birth of NRHM were manifold. However, a few events drew the attention of the policymakers in India to the health sector. Firstly, the millennium development goals (MDGs, rechristened as sustainable development goals SDGs) were agreed to by the 189 member countries of the United Nations in September 2000. Secondly, the publication of the report of the *Commission of Macroeconomics and Health* (CMH). Thirdly, publication of *India Health report*. Fourthly, the release of National Health Policy 2002; and finally lobbying from the civil society in the run-up to the general elections in 2004, all that contributed in putting health issue at the center stage of political discussion. Though there was a precedent in the form of Reproductive and Child Health (RCH 1) which was operational since 1997 and there was a feeling that all this would result in a sequel in the form of RCH II. But the civil society and more importantly the interest was shown by the then Prime Minister's Office with regard to changing the fundamentals of health sector governance sowed the seeds of NRHM. The ex-Secretary of Ministry of Health and Family Welfare in her recently published book puts it aptly that 'NRHM was an effort to change the very structure and the methodology of the functioning of the health sector in the near future' (Rao, K. Sujatha, 2017).

In that background, the National Rural Health Mission was launched in a mission mode to make affordable and quality public health care system available to masses. In doing so targets needed to be set that could be monitored to check the progress of the programme. As such timelines for achieving key health-related milestones were set. Prominent among them was to bring infant mortality rate (IMR) to 30 per 1000, brining maternal mortality rate (MMR) to 100 per 100,000 live births and the total fertility rate (TFR) to 2.1. Apart from these, there were targets with regard to the expansion of physical health infrastructure in the form of building new and upgrading the existing ones. This was outlined at various levels of the health infrastructure like the district level, Community Health Centres (CHC), Primary Health Centres (PHC) and sub-centre level. In addition, the '*Framework for Implementation 2005-2012*' also came up with a staggered timeframe for implementing various schemes/targets under the programme (Government of India, 2006). For example, to provide fully trained Accredited Social Health Activists (ASHA) for every 1000 population (to be achieved by 50% by 2007 and 100% by 2008) and two Auxiliary Nurse Midwifery (ANM) in each Sub Health Centres strengthened/established to provide service guarantees as per Indian Public Health Standards (IPHS) in 1, 75000 places (30% by 2007; 60% by 2009 and 100% by 2010).[6] Though these targets were set in a very clear cut manner. The programmes did not show early results, as the programme had a sluggish start. To begin with, the programme was launched in April 2005 and the framework for implementation guidelines was approved only in July 2006 (NHSRC, 2007). In early 2005, after the launch of the progragmme it was realized by the government agencies (the erstwhile Planning Commission now rechristened as *Niti Aayog* and the Department of Finance) thought it to be non-starter as it is falling short in terms of goals, timelines and anticipated impacts at the end of the Tenth Plan period (Rao, K. Sujatha, 2017).

Despite the initial hiccups in the implementation of the programme the NRHM, the programme got implemented in a gradual manner. The programme had a mandate to provide comprehensive primary care in an integrated manner but gradually the focus got shifted to the goals of reducing IMR and MMR. Rao, K. Sujatha (2017) is of the view

[6] This IPHS recommends two ANM (one essential & one desirable) per Sub-centre. The ANMs have been trained in midwifery, they may conduct normal delivery in case of need.

that "two interventions – ASHA and JSY dominated all sense of achievement." As such the critical components that the NRHM carried on were ASHA, JSY, and physical health infrastructure expansion. The importance of physical access and quality of health care was important for the government and that is evident from the fact that in addition to the individual survey government also conducted a survey on health facilities at various administrative levels which came to be known as "Facility survey".

The National Rural Health Mission has three distinct components (from hereinafter they will be referred to as NRHM components):

A. Janani Surakshya Yojana (JSY) meaning financial assistance for health facility delivery /institutional delivery;

B. Accredited Social Health Activist (ASHA) meaning a community health worker is provided in every village (one ASHA per 1000 population); and

C. Expansion of physical infrastructure in the health sector in terms of provisioning of new health facilities at various levels {district, community and village (sub-centre) level} or upgrading the existing ones.

1.3 Research objectives and main findings

As discussed in the previous section, the NRHM was introduced as one of the flagship programmes of Government of India for improving health indicators in the country and also to meet the MDGs. To do so, the NRHM programme had targeted both the supply and demand-side factors of the health services. Thereby creating an enabling health environment for increased take-up of health services. The improvement of health services in the country is to a large extent contingent on the outcome of the NHM programme, which accounts for more than 50 percent of the central health ministry's total expenditure.[7] As such an objective evaluation of the programme is relevant and pertinent to track its achievement and pitfalls. The extensiveness of the programme also is gauged from the key features outlined in NRHM's first implementation framework approved by the Cabinet in 2006.[8] It states:

"...the goals of the Mission include making the public health delivery system fully functional and accountable to the community, human resource management, community involvement, decentralization, rigorous monitoring & evaluation against standards, convergence of health and related programmes from village level upwards, innovation and flexible financing and also interventions for improving health indicators"

Existing literature in peer-reviewed journals on the evaluation of NRHM has been restricted to the conditional cash transfer known or the Janani Surakshya Yojana (JSY). As per our knowledge, other components of the NRHM mainly the impact of community health worker (ASHA) and expansion of the physical health infrastructure (Sub-Centre) has not been done carried out so far. Thus, our study provides the first evidence on these aspects of NRHM. In fact, the literature on the physical health infrastructure's impact on health outcomes comes mainly from developed countries and African subcontinent.

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[7] The funding allocation for National Health Mission in 2018-19 was Rs. 30,130 Cores accounting for 55% in 2018-19 which has come down over the years from 73% in 2006-07, which could be attributed to increased devolution of resources to the states following 14th Finance commission's recommendation (PRS legislative research, Demand for Grants 2018-19), available at https://www.prsindia.org/parliamenttrack/budgets/demand-grants-2018-19-analysis-health-and-family-welfare, accessed on 10th July 2019.

[8] National Rural Health Mission, Meeting People's Health Needs in Rural areas, Framework for Implementation, 2005-2012, Ministry of Health and Family welfare, Government of India.

Impact evaluation studies of community health worker on health outcomes come mainly from the South American countries like Brazil and some Asian countries like Pakistan and Bangladesh, but not from India. Finally, there is no study in the refereed journals that have looked into the interaction of the demand and supply side of the NRHM programme.

The main research objective of this thesis is to evaluate the impact of various components of the NRHM (conditional cash transfer i.e. JSY, community health worker i.e. ASHA and physical infrastructure expansion i.e. sub-centre) on mortality and health services utilization outcomes. The hypothesis of this thesis is that with increased coverage of NRHM components leads to a reduction in mortality, which has been brought about by increased utilization of the health care services like delivery in the health facility, birth in the presence of skilled health personnel, ANC check-ups and breastfeeding during the initial hours of birth. Our hypothesis finds support from the data itself (Figure 1.1). Figure 1.1 shows, based on the raw data used for this study, shows a decline in mortality indicators in the post-programme period (post-2005). However, the decline is more prominent in the post-2008-09 period. And this decline comes with a concurrent increase in take-up of health care services like delivery in health facility, at least three ANC visits, delivery in the presence of skilled birth attendant and increased breastfeeding in early of hours of birth.

We find that increased coverage of conditional cash transfers for institutional delivery, awareness creation by the community health worker and physical infrastructure expansion reduce infant, neonatal and one-day mortality. Also, the magnitude of the reduction in mortality increases with an increase in coverage of NRHM components. In general, there is an increased health services utilization with an increase in coverage of conditional cash transfer, community health worker and physical infrastructure which can be seen from higher uptake of skilled birth attendance and breastfeeding in the initial hours of birth. The point estimates are particularly significant for higher levels of coverage implying areas with higher coverage of NRHM components tend to have a higher uptake of health care services. There are some notable deviations from this general trend. First, the health facility birth and public health facility birth are found to have more take up and private facility birth shows less take up with increased coverage of conditional cash transfer (JSY) and community health worker (ASHA). This suggests that there is some degree of substitution of private facility birth for public facility birth. Second, with increased coverage of community health worker (ASHA), there is increased ANC check-ups. The interaction effects show that conditional cash transfer (JSY) for health facility birth and health facility availability (Sub-Centre) are working as substitutes.

The main contribution of this thesis is providing the first evidence on mortality reduction through financial incentives by using the difference-in-difference method. Earlier research found some evidence on mortality but with using a different method which has many limitations (Lim, S.S., et. al, 2010). And the study which did use the diff-in-diff method did not find any evidence on mortality (Powell-Jackson, T. et. al, 2015). The thesis also provides the first evidence on mortality reduction and increased health services utilization through increased awareness by a community health worker in the Indian context. Other studies provide some evidence from south American countries like Brazil and (Brentani et. al, 2016; Macinko J. et. al., 2007) a few south Asian countries like Pakistan (Bhutta et.al., 2011). Further, compared to other studies on demand-side intervention like community mobilization which are designed and implemented by donor agency along with some Non-Governmental Organization (NGO) in India, the community health worker per 1000 population, ASHA component of the NRHM programme, is an all India programme run by the Government of India and this study analyses the impact of this programme over a ten-year period, providing a comprehensive geographical and temporal coverage (More, N.S., et. al., 2012; Tripathy, P., et. al., 2010). Similarly, studies on India on financial incentive focused on small geographical region and tracked the programme for few years only (Gupta, S.K., et. al, 2012; Randive, B. et. al., 2013; Chaturvedi, S. et. al., 2015). This study again improves upon the existing literature both in terms of temporal and spatial coverage and also in terms of finding causality between JSY coverage and reduction in mortality outcomes. As such this study has high level of original contribution to the extant literature and external validity. The thesis provides the first evidence from Asian continent on the impact of physical health infrastructure coverage leading to increased take-up of health facility services in the form of increased skilled birth attendance, health facility birth, and breastfeeding in the initial hours after birth. Existing studies are mostly concentrated in Africa (Thaddeus and Maine, 1994; Sabina and Oona, 2009; Manang, F. and Yamauchi, C., Forthcoming). Last but not least, this thesis also provides first evidence on the interaction effects of the demand and supply side factors that affect the health outcomes in India. To the best of our knowledge we have not come across any other peer-reviewed study on the interaction between the demand-side and the supply side components of the same programme.

1.4 Roadmap to the dissertation

This thesis focusses on the coverage of the conditional cash transfer (JSY), Community Health Worker (ASHA) and physical infrastructure and looks at the impact of each of these NRHM components on the mortality outcomes and health services uptake including breastfeeding. In chapter 2 we track the coverage of the JSY programme and also analyze the impact of the programme coverage on the various mortality outcomes and health services utilization. In Chapter 3 we will analyze the main effects of coming in contact with a community health worker (i.e. ASHA). It analyses how coming in contact with ASHA affects mortality and behavior of women in taking up the pre-natal and post-natal care. Chapter 4 examines the impact of having a sub-centre in the locality. The chapter tries to answer the question that does having a Sub-centre nearby in the locality impact health services uptake and hence mortality? Finally, in chapter 5 we look at the interaction effects the NRHM components on morbidity. Chapter 6 concludes the study but summarizing the main findings of the study, outlines some of the limitations of the study and lays down future areas of research on the topic.

Chapter 2
Impact of Financial Incentives on Health Outcomes in India

2.1 Background

Indian constitution under Article 21 provides for Right to Life which has been liberally interpreted by the apex court in India (i.e. the Supreme Court of India). Also, Article 47 of the Constitution of India provides for improving public health is considered to be one of the primary duties of the Government. As such, improvement in health indicators is one of the parameters on which a Government can be made accountable by the people of the country. Good health and well-being (Goal 3) is one of the key goals of the Sustainable Development Goals (SDGs). Around the world, about 400 million people do not have access to basic healthcare (UNDP, 2018) and studies have suggested that people get indebted for hospitalization due to high out-of-pocket expenditure.

In India, both the demand and the supply of the basic health care facility needs to be strengthened. Access to healthcare has been constrained by the lack of availability of primary health care. However, availability of the facilities by themselves is not sufficient, as people especially women in the rural areas have a reservation in discussing health issues in public. Caste, cultural and religious barriers have their own effect on people's behavior with regard to various health issues.

Hurst, Taylor E., et. al (2015) provides a comprehensive literature review on demand-side intervention like community mobilization and financial incentive on health services uptake and mortality outcomes.[9] The study found that almost all the studies

[9] After screening, 582 articles, selected 50 for a full review of which 16 met their criteria for extraction.

provide evidence of increased utilization of health services. But, the evidence pertaining to the association of increased take-up of health services on reduction in early neonatal and maternal mortality is mixed. There are studies that look into the association of JSY with health services utilization and consequently its impact on maternal mortality. One of such studies is Gupta, S.K., et. al (2012). This observational study from a tertiary-care hospital in one of the states of India (Madhya Pradesh) using data from the pre-JSY phase of 2003-2005 and JSY-phase (2005-2007), studied the impact of JSY on take-up of institutional delivery and reduction in maternal mortality. The study found that after the implementation of the JSY programme there was a 43 percent increase in institutional deliveries and maternal mortality is lower for more educated women as compared to illiterate women. Randive, B. et. al. (2013), in another study on impact of JSY on maternal mortality, studied the implementation of JSY programme using the Annual Health Survey (2010-11) from 284 districts in nine states. The objective of the study was to identify the association between service uptake in terms of the proportion of institutional delivery and maternal mortality. They found that the proportion of institutional birth increased from 20 percent to 49 percent in five years. But, the study did not find any significant association between institutional birth proportion and maternal mortality. The study concludes that it may be necessary but not sufficient condition maternal mortality reduction, recognizing the quality of institutional health care may also be an important factor. The quality of health care services as one of the concern areas has been identified by other studies as well. Chaturvedi, S. et. al. (2015) in their qualitative study on intrapartum care in 11 facilities in Madhya Pradesh in India examined whether the JSY cash transfer programme is helping skilled birth attendance. The study, based on observation and interview, finds quality of health care to be of lower standards.

Inefficiencies in the health system and organizational structure is leading to inadequate skilled birth attendance. As such it emphasizes increasing the quality of obstetrics care before increasing the coverage of the JSY cash transfer programme.

There are studies that found impact of JSY on neonatal mortality. The study by Lim, S.S., et. al (2010) using the matching and before and after design, the study found that due to the implementation of JSY programme there is a fall in neonatal mortality by 2 to 6 deaths per 1000 live births. Though it did not find significant impact while using the difference-in-difference approach. However, Powell-Jackson, T. et. al (2015) using in the difference-in-difference method and data from 2002/03 to 2007/08, studied the early evidence of the impact of financial incentive on mortality, health services uptake and some 'unintended outcomes'. They found some impact on health services uptake increase with the financial incentive but did not find any significant and strong impact on mortality especially neonatal mortality.

This study aims to determine whether increasing the coverage of health services by providing financial incentives (JSY), improves the overall health outcomes. The data shows that the real coverage of the JSY programme picked up after 2007/08 (Figure 2.1). As such, we examine the implication of NRHM components coverage on mortality and health services utilization for the period 2001/02 to 2011/12. Contribution of this study is that it provides evidence on impact of JSY which has very high external validity as opposed to existing observational studies confined to a few states in India and for couple of years. This study uses an extensive dataset that includes almost all the states and UTs in India and is tracked for a decade (2001/02 to 2011/12). Also, our contribution to the existing literature is that we found stronger new evidence in terms of the impact of JSY on various mortality indicators, specifically on neonatal mortality and also on health service utilization.

2.2 Janani Suraksha Yojana (JSY) – a financial incentive for institutional birth[10]

The JSY launched in April 2005 by the central government as a 100 percent centrally sponsored scheme with the sole objective of reducing maternal and infant mortality by promoting institutional delivery for the poor pregnant women from the rural areas. However, the scheme was later expanded even to the urban areas from 1st April 2006, thereby including women from Below Poverty Line (BPL) in the urban areas. Further, since 31st October 2006, the scheme was extended to SC/ST pregnant women irrespective of poverty criterion.[11]

The scheme segregated the states into high focus and low focus states based on the percentage of institutional delivery in the states and UTs. The scheme focuses on the poor pregnant woman with a special dispensation for ten states called Low Performing States (LPS) that have low institutional delivery rates.[12] The remaining States/UTs have been named High Performing States (HPS). The eligibility criteria are different for the LPS and the HPS. The criteria vary based on the age of the pregnant women, the number of birth and poverty level. Also, the compensation package both for the mother and the

[10] This section draws information heavily from "Features and Frequently Asked Questions and Answers", Ministry of Health and Family Welfare, Government of India (2006). Available at: https://mohfw.gov.in/sites/default/files/FEATURES%20FREQUENTLY%20ASKED%20QUESTIONS.pdf, accessed on 10th July 2019.
[11] This information is available from one of the states i.e. Punjab implementing the programme. Available at: http://pbhealth.gov.in/pdf/JSY.pdf, accessed on 10th July, 2019. Also available in FAQ (2006) referred to in the footnote above.
[12] These states are Uttar Pradesh, Uttarakhand, Bihar, Jharkhand, Madhya Pradesh, Chhattisgarh, Assam, Rajasthan, Odisha, and Jammu and Kashmir.

ASHA differs in the LPS and HPS. The BPL criterion is not applicable for the women from the LPS states. The BPL criterion is only applicable to HPS states. However, if a woman is from the Scheduled Caste (SC) or Scheduled Tribe (ST) and delivering in a public facility or accredited private institutions then she is eligible for the cash benefit, the BPL criterion is not applicable. The differential eligibility criteria for the LPS and HPS states is given below:

Category of States/UTs	Eligibility Criteria	Eligibility (in terms of number of births)
LPS states	• All pregnant women delivering in Government health centres or accredited private institutions. • No age restriction to avail the scheme • No need for any marriage or BPL certification	All births, delivered in a Government or Accredited Private health institutions.
HPS States	• BPL pregnant women. • Aged 19 years and above.	Up to 2 live births.

The financial incentive for the different categories of states area wise for the mother and for the community health worker (ASHA) is given in the table below:

	Rural Area			Urban Area		
Category of State	Mother's Package	ASHA's Package	Total	Mother's Package	ASHA's Package	Total
LPS	1400 (22)	600 (9)	2000 (31)	1000 (15)	200 (3)	1200 (18)
HPS	700 (11)		700 (11)	600 (9)		600 (9)
NE* (Except Assam) & Rural areas of tribal districts of HPS states**	700 (11)	600 (9)	1300 (20)	600 (9)	200 (3)	800 (12)

Note:
*Secretary(H&FW) do letter no. Z. 140171112005-NMBS/JSY dated the 31st Oct 2006.
**Addl. Secretary, MoHFW do letter no.Z. 14017/1/2005-NMBS/JSY dated the 27th Nov 2006.
LPS: Low Performing States, HPS: High Performing States, NE: North-Eastern States
Values are in Indian Rupees (Rs.). The equivalent dollar values are given in the parenthesis (exchange rate assumed at 1$ = Rest. 65). The JSY scheme, both for LPS and HPS states, provides for cash assistance of Rest. 500/- ($8) per delivery for BPL pregnant women preferring to deliver at home provided she is aged 19 years and above. The cash assistance is for up to 2 live births and the disbursement is at the time of delivery. The rationale for this provisioning being the beneficiary would be able to use the money for her care during delivery or to meet any other expenses of delivery.

The magnitude of the incentive can be gauged by comparing it to the benchmark amount of $1.9 a day that World Bank used for its poverty estimates.[13] A rough calculation says that a BPL family with $57 per month getting financial incentive under JSY of $22 in the LPS states amounts to 39 percent of the monthly income. Tripathy et. al (2017) found that the median expenditure is US$ 54 for one episode of hospitalization for childbirth. Defining "catastrophic expenditure" as out-of-pocket (OOP) expenditure of more than 10% of annual expenditure, it found that private sector has higher prevalence of catastrophic expenditure as compared to public (60% vs. 7%). However, they also found that the indirect cost (which includes transport for patient and others, expenses on food, escort, lodging charges and others, etc.) constitute 43 percent of the total cost of delivery for public sector hospitalization. This indicates the JSY provisioning of transport cost, discussed below, may not be enough to cover the actual cost incurred on transport by the patient. Also, the travel and lodging expenses of person accompanying the pregnant women is not covered. The incentive under JSY does not cover the entire expense of childbirth.

[13] Recent estimates of World Bank use $1.9 a day to target poverty for 2030. Available at https://www.worldbank.org/en/news/press-release/2018/09/19/decline-of-global-extreme-poverty-continues-but-has-slowed-world-bank, accessed on 10th July 2019.

ASHA is an important link in the programme as she is responsible for motivating and arranging for institutional delivery of these poor pregnant women. The ASHA is entrusted with various pre and post-natal care responsibilities.[14] She is also responsible for making arrangements for the transport of the women to the nearest health facility, for which a separate cash entitlement is kept under the JSY.[15] Cash entitlement for beneficiary mother and ASHA worker differs from state to state, though there is a minimum threshold provided by the central government, the state government can provide additional remuneration if it so desires. The cash incentive to ASHA called as "ASHA package" is available in all LPS, North-Eastern (NE) states and tribal districts of all states and UTs. "ASHA package" is Rest. 600 ($9) which is sub-divided into three components.[16]

1. The first component is JSY entitlement for referral transport for going to the nearest health centre for delivery. Though, the state will determine the amount of assistance which depends on the topography and the

[14] ASHA's responsibilities includes identification of the eligible women and to report or facilitate registration for ANC, assisting the pregnant women to get in getting necessary certification wherever needed, providing and/or helping women to receive at least 3 ANC checkups including TT injections and IFA tablets, identification of a functional government health centre or accredited private health facility for referral and delivery, counsel the women for institutional delivery, accompany the eligible women to the pre-determined health centre for delivery and to stay with the women until she is discharged, arranging for immunization of the baby till 14 weeks, intimating the birth or death of the child or the mother to the ANM/MO, visit the beneficiary for post-natal care within 7 days of delivery to track her health and facilitating to obtain care if needed, and to counsel for initiation of breastfeeding to the newborn within one-hour of delivery and its continuation till 3-6 months and also promote family planning.

[15] In the case where the ASHA fails to organize transport for the pregnant woman to go to the health institution then the transport assistance money available within the ASHA's package should be paid to the pregnant woman at the institution, immediately on arrival and registration for delivery. An undertaking from the JSY beneficiary could be taken to determine who has paid for the referral transport (ASHA or the beneficiary).

[16] Details of this break is from NHSRC, available at: http://nhsrcindia.org/sites/default/files/Discussion%20paper%20on%20JSY%20Issues%20NHSRC.pdf, accessed on 10th July 2019.

infrastructure available in the state. But, in any case, it cannot be less than Rs.250 per delivery case.

2. The second component is the cash incentive of Rest. 200 to ASHA per delivery for her facilitating institutional delivery.[17]
3. The third component covers the transactional cost of ASHA given to her for accompanying the pregnant women to the health centre for delivery and to meet her cost of boarding and lodging etc. during this. This is amount is the balance from Rest. 600 (after paying for the referral transport and Rest. 200 cash incentive to ASHA).

However, it may be noted that the JSY scheme clearly specifies that the assistance package to the ASHA or an equivalent worker is available only if she works and assists the pregnant women. In the case the pregnant women do not take the assistance of an accredited worker either because no ASHA is in position then she should be paid the sum total of both the packages.

This study has some advantages in the form that the NRHM is a nationwide programme implemented on a nation-wide basis. Even though the programme was officially launched in 2005, it spread across the various districts in India in a gradual fashion, providing variations in the implementation of various components of the programme. The health facilities and outcomes are similar within a state. As such, we can be confident about our estimates not coming from other state or national programme.

[17] It must however be ensured that the cash incentive to the ASHA should not be less than Rs.200/- per delivery case facilitated by her. This is essential to keep her sustained in the system

Lastly, we can make claims about external validity as the programme is for the entire country covered in a gradual fashion.

2.3 Data

This study uses pooled cross-section data that includes three rounds of DLHS data [(DLHS-2, 2002-2004), (DLHS-3, 2005-2008) and (DLHS-4, 2010-12)] that covers birth from the year 2001 to 2012 and Annual Health Survey (AHS) for 2010-12. The AHS data is collected by the Registrar General of India (RGI) under the Ministry of Home Affairs, which is the agency that conducts a decennial population census. The DLHS data is collected by a designated agency International Institute for Population Sciences (IIPS), Mumbai as per Government of India directive. The agency oversees the sampling design, data collection and maintaining the database. In the survey, a detailed interview is carried out of married women who are in the age range of 15-49 years. The dataset provides a wide range of data on the individual, household-level characteristics and choices the women make during their pregnancy. Most importantly this data set provides unique district level identifier as such we are able to track the coverage of the NRHM programme over all the districts that are consistently available across all the rounds of the survey. We could identify 587 districts that were available across DLHS-2 and DLHS-3. However, there were some states (Gujarat, Delhi and some Union Territories) which were not covered at all in DLHS-4. As such, the number of districts comes down to 547 in case of DLHS-4. In case of facility survey five metropolitan cities like Delhi, Mumbai, etc. are not covered and data pertaining to 13 districts of state named Nagaland is not collected in DLHS-3. As such, for the facility survey, the number of districts falls to 529 districts for the analysis.

2.4 Definition of JSY coverage and other variables

JSY coverage is a district-level coverage. It refers to the ratio of the number of women who delivered in a public health facility and also received financial incentive under JSY to all the deliveries that took place in the public health facility of that district that year. We define the JSY coverage in this manner because if the financial incentive has to have any impact on the health outcomes the eligible women should be aware of the information about such benefits under the JSY proragmme. The UNFPA (2009) study found that four-fifths of the women were aware of the scheme and almost half of women giving birth in a health facility received the JSY cash.[18] In addition, for the purpose of comparability and consistency, we are using the same definition of JSY coverage as done by the Powell-Jackson et. al (2015) study. We believe that this definition is not the best way to capture the coverage variable because by limiting to only public health facility birth we are losing out on other facility birth, especially private ones. And the JSY programme does not limit itself to the public facility birth. In fact, any women who deliver in an accredited private health institution are also eligible to get the benefit under the JSY programme. For the JSY study, we follow the same definition for JSY coverage as used in the existing literature for comparability. But, for our study on ASHA, we do not restrict the coverage variable to public health facility birth rather we measure the coverage as a ratio to all the deliveries that take place in that district in a particular year for the entire study period. We will discuss this in detail in Chapter 3.

[18] Though 4/5th of women is aware of the incentive still the take up of JSY is not that impressive as it expected to be as there is much scope for improvements in the quality of service, hospitality and family support received at the time of childbirth (Devasenapathy, N., et. al., 2014) and on account of out-of-pocket expenditure (OOPE) that the patients have to incur in the form of indirect costs associated with the childbirth such as “informal payments to staff, food and items purchased for the infant” (Sidney, K., et. al., 2016).

The definitions of the outcome variables are given below:

Infant mortality: no. of deaths under one year of age

Early Neonatal mortality: no. of deaths within 7 days of birth

Neo-natal mortality: no. of deaths within 28 days of birth

One-day mortality: no. of deaths within 24 hours of birth

Health worker in attendance at delivery: All the in-facility birth and birth at home attended by a skilled health professional like a nurse, midwife etc.

Health facility birth: birth at a health facility

Public health facility birth: a birth that took place in a public facility i.e. a government hospital, CHC/Rural Hospital or PHC

At least 3 ANC visit: the pregnant women went through at least three Ante-Natal Care visits

Private facility: birth at a private hospital, private trust, private clinic, etc.

Breastfeeding within 1 hour: Breastfeeding the baby within the first hour of the birth

Breastfeeding within 24 hours: Breastfeeding the baby within the first 24 hours of birth.

2.5 Identification strategy

We use difference-in-difference as our identification strategy for evaluating the impact of all the three components that is financial incentive (measured by JSY); awareness (measured by coming in contact with ASHA) on a number of health outcomes including mortality; and physical infrastructure expansion (measured by building up of new sub-centre and upgrading the existing ones). In our analysis, we have a baseline model that includes district fixed effect and year fixed effect, which controls for the unobservable time-invariant common for a particular cohort (a district in our case) and also time trend. We also include other covariates to our baseline model in order to check for robustness of our estimates.

The extended model in addition to the baseline model includes two sets of other controls: district-level controls and individual level controls. The district-level controls include the interaction terms of the birth year and proportion of the population living below the poverty line, proportion of tribal people and average wealth in the district. Furthermore, the individual controls include education of mother, education of father (in some cases only), age of the mother at the time of birth, the recall period (time gap between year of interview and that of the birth), and dummies for place of dwelling (rural-urban), religion (Hindu, Muslim, others), multiple births and for survey rounds. The causal variables are the coverage of JSY (financial incentive scheme) and the coverage of awareness coverage in terms of coverage of ASHA, the health workers. The causal variables, JSY, ASHA, and Sub-Centre coverage are categorical variables. The JSY coverage is categorized into four coverage intensity: 0-10%, 10-25%, 25-50%, and 50% and above, the 0-10% category is the base level group. Similarly, but with different intensity, the ASHA coverage is categorized into four coverage intensity: 0%, 0-5%, 5-20%, and 20% and above. The 0% category being the base level category. The Sub-centre coverage is grouped into four categories based on their availability per 10,000 (ten thousand) population: 0-0.5, 0.5-1, 1-1.5 and 1.5 and above with 0-0.5 being the base category.[19] The difference in the categorization of the JSY, ASHA, and Sub-Centre comes from the inherent nature of these components. While giving financial incentive (JSY) to mothers who come to deliver in the health facility is relatively easy to implement and less time and manpower consuming as compared to creating awareness and motivating pregnant women to go for ante-natal checkups (ANCs) and spreading information about benefits of breastfeeding the newborn. Still more difficult is to build a new physical facility in the form of sub-centres at village level and to staff them with adequate manpower and equipment. The JSY, ASHA, and Sub-Centre differ in their intensity over time, as such, we would be assessing their impact separately. However, in the end, we will also look at the impact of these coverages taking them together and also interacting them to see the additional impact of each coverage given the others.

We also include interaction terms of year of birth with other district-level covariates like wealth, the tribal share of population and poor share of the population to control for any confounding of variables. For the district level parameters, we use the data from DLHS-3. The data for wealth is not available in the DLHS-2 and DLSH-4 dataset. As such we are here substituting differential trend for actual trends.

Each observation in our dataset represents a birth for the latest birth of the women covered in the survey between the age of 15-44. We use the dataset at the individual level. We used the data for the latest birth for all our analysis. Though we have also performed robustness checks by including all births of women also. However, going beyond the latest birth does not make sense in case of JSY as the question in the survey asks the women whether she received the JSY money for the last birth only. The coverage of the

[19] A sub-centre coverage of 1 implies 1 per 10,000 population and 2 implies 1 per 5000 population.

NRHM programmes (JSY and ASHA) are measured at the district level as the intensity of these programmes could be traced maximum to this administrative level. A district is the first formal administrative set-up where the implementation and monitoring of the programme implementation take place.

In our analysis, we use the district level coverage and match them with the individual outcomes for each birth. As such our explanatory variable is exogenous by construction. Matching individual-level exposure to the programme with the individual health outcomes suffers from the problem of endogeneity as the exposure the programme is influenced by individual-level characteristics, as such establishing causal impact of exposure on health outcomes becomes difficult. Despite the advantages of our analysis, we do not make a strong claim on causality as non-random selection of districts and State that implemented the programme might themselves have been committed and motivated to reduce mortality.

Though the programme targeted for the high focus states (or low performing) to begin with we are using the district level variations in the intensity of the programme, not the state-level variation. This is because districts even in the non-focus states were also covered during the study period. As such we are using the within-state variations and not between states. For example, the ASHA programme started in the 18 high focus states to begin with but immediately followed up by covering tribal areas of all the states irrespective of whether it is high or low focus state. We are also clustering the standard errors at the district level as we are using the variations in the implementation of programme intensity at this level.

The model

$$Y_{itd} = \beta_0 + \beta_1 \text{ (JSY coverage 10-25\%)}_{td} + \beta_2 \text{ (JSY coverage 25-50\%)}_{td} + \beta_3 \text{ (JSY coverage >50\%)}_{td} + \beta_4 W_{itd} + \beta_5 \theta_t Z_d + \gamma_d + \delta_t + \varepsilon_{itd} \quad \ldots. (2.1)$$

Where,

Y_{itd} is the health outcome variables that are broadly categorized into mortality indicators, health services utilization and breastfeeding of the programme. These outcome variables are binary i.e. for example, infant mortality takes the value one if the child dies during the first year of birth and zero otherwise. The same way all other outcome variables are defined.

JSY Coverage categorical variables:

The base/reference category is JSY Coverage 0-10% to which all other JSY coverage coefficients are compared to.

JSY Coverage 10-25%: is a dummy variable which is one if the JSY coverage is between 10-25% and zero otherwise. Other JSY coverage i.e. JSY coverage 25-50% and JSY coverage >50% are dummy variables defined in the same manner.

W_{itd} refers to the individual level covariates like the education of mother, education of father, age of the mother at the time of birth, the recall period (which is the time gap between year of interview and the year of birth the child), and dummies for place of dwelling (rural-urban), religion (Hindu, Muslim and others), multiple births and for survey rounds.

Z_d represents the district level factors like the average wealth at the district level and share of poor and tribal population in the district.

θ_t refers to the year of birth of the child.

γ_d is the district level fixed-effects

δ_t captures the time fixed-effects (year of birth of a child)

2.6 JSY coverage

The financial incentives for institutional delivery saw a gradual take up. In the first financial year 2005-06, only about 27 percent of the districts (161 districts) had a JSY coverage of more than 25 percent. However, over the years this ratio increased for the higher coverage ratio. In the financial year 2011-12, almost 86% of districts (469 districts) had a JSY coverage of more than 25 percent. In fact, 344 districts recorded more than 50 percent JSY coverage. Thus, the coverage of JSY has been quite rapid as it has increased three-fold the number of districts under JSY coverage of more than 25% in seven years (Table 2.1). Though the low focus states did not see the same coverage expansion in terms of the magnitude they do see some increase in coverage. For example, the category of JSY coverage 25-50% see a doubling during from 51 districts (or 22 percent of all low focus districts) in 2005/06 to 103 districts (53 percent of all low focus districts) in 2011/12. The expansion we do not see in the low focus districts is JSY coverage over 50 percent. Thus, though the sates have been identified by “high” and “low” focus for the implementation of the JSY programme it seems it has not been strictly followed during the implementation of the programme. As such, for our analysis, we use all the districts from all the states available in the data set and not restrict ourselves to high vs. low focus states.

The variations in the district level JSY coverage is not random. Evidence from the literature (Powell-Jackson et. al, 2015) and discussion with the policymakers suggests that there was some kind of targeting based on the socio-economic characteristics at the district level. The way the programmes under NRHM were designed there seems to be an underlying message to the implementing agencies at the state and the lower level (i.e. the district) that the benefits of the programme should go to the deprived section of the society first and later on universalize it. As such the factors like the proportion of poor people, the proportion of tribal people and the average wealth of the district seems to have played an important role in the decision with regard which districts gets the programme first. In addition to the qualitatively examining this issue, we also evaluated it empirically using district-level data with regard to JSY coverage and variables that might be affecting the coverage itself. The regression result is at Table A 2.10 which shows that after including state fixed effects (column 4 & 5), we find that the share of poor population and the share of tribal population in a district does influence the JSY coverage. Implying that the district level socio-economic characteristic does influence the district which gets the programme early. We also ran the regression of JSY coverage on the government facility birth at the baseline implying for the financial year 2004-05 and did not find the coefficient to be significant which reassures that the coverage is not driven by any other factors like the demand of the health facility in the pre-period.

2.7 Main effects: JSY[20]

. Our contribution in this chapter is to present fresh evidence on the impact of the JSY programme on mortality outcomes increasing the time-period covered in the post-period. Existing studies provide only early evidence of the impact of JSY on mortality and health outcomes (Powell-Jackson, T. et.al., 2015). However, we believe the real expansion of the JSY took place post-2007-08, therefore we increase the period of study to 2011-12. The definition of the coverage of JSY is the ratio of the number of women who gave birth in a public facility and received the money under JSY to all the births that took place in the public health facility. We have restricted our analysis only to the latest birth of the women. We also used all the live births and did not find any significant difference in the direction or significance of the result. As such, we continue to use data pertaining to the latest birth of a woman (Table A 2.11 & Table A 2.12).

2.7.1 Mortality

Table 2.2 shows the estimates from our baseline specification. Panel A includes district and year fixed effects. Panel B in addition to the basic specification controls for district characteristics and individual demographics.

[20] As we are handling large dataset coming from different sources, for academic curiosity, we tried to reproduce the results from the study of Powell-Jackson, T. et.al (2015). This served as a way to check the robustness of our data management, nothing else. We did not get numerically same results as with the study but we got results very close to their results. The minor differences in the point estimates seems to be creeping in from difference in number of observation. As we do not know exactly how they got the final data, it is almost impossible to get exact point estimate in such a large dataset with so many variables to be constructed from the raw data. We put all these results in the Appendix Table of this chapter i.e. Table A 2.1-A 2.3 and we do not explain them here as the published paper has already done that. We got one Stata "do" file from the authors but we did not get the final do files nor did we get any other do files used for cleaning the data. We did not even get the dataset used by them. The reproduction is therefore based on understanding that we could gather from the description in the published paper.

Panel A shows that the coverage has a significant negative impact on mortality outcomes whichever way we define it. It shows that as the coverage of JSY increases the impact on mortality intensifies implying strong evidence of JSY coverage on mortality outcomes. Starting at 10-25% coverage, we find a significant negative impact of JSY coverage on mortality and the impact magnifies with the increase in coverage, which is consistent with the belief that we would expect fewer deaths where the incentive has been provided for institutional delivery. Column (1) shows that at coverage 10-25% the expansion of JSY reduces infant mortality by 8 deaths per 1000 last births as compared to the base category (i.e. JSY coverage 0-10%) and the reduction in mortality intensifies to 15 fewer deaths per 1000 last births for the JSY coverage of 25-50%. Column (2) shows that at coverage 10-25% the expansion of JSY reduces neo-natal mortality (i.e. mortality within in the first month of the birth) to 12 deaths per 1000 live births and the reduction in mortality intensifies to 19 fewer deaths and 21 fewer deaths per 1000 last births for the JSY coverage of 25-50% and JSY coverage >50% category, respectively. Column (3) - (4), is the breakdown of neo-natal mortality and the nature and extent of the coverage do not change with the what definition we choose for the mortality indicators. Regions with JSY coverage of 25-50% have 0.18 percentage points less one-day mortality compared to the base category of JSY coverage of less than 10 percent.

Including extensive controls for potential confounders, the point estimate does not change much. We still observe a significant negative impact of JSY coverage on mortality in terms of infant mortality, neonatal mortality and one-day mortality. Thus, we find a large negative effect of JSY coverage on infant mortality, neonatal mortality and one-day mortality. These findings substantiate our hypothesis that the JSY coverage indeed took place at a faster pace in the period following 2007-08 and it provides a reason for why the earlier studies (Powell-Jackson et. al, 2015) did not find any impact on the mortality outcomes. However, our estimates on mortality are in line with the study by Lim et. al (2010), as their mortality effects were negative and statistically significant in two out of three identification strategies they use.

2.7.2 Health services uptake and breastfeeding

Table 2.3 (Panel A) shows the impact of JSY coverage on health facility birth, public health facility birth, private facility birth, number of ANC visits and breastfeeding. It also measures the impact on health worker in attendance which apart from including health facility birth also includes birth at home but being attended by a skilled health professional. Column (1) shows that with increased JSY coverage, women giving birth with skilled persons' attendance has gone up. Implying that the likelihood of giving birth with the presence of health personnel in a district with JSY coverage >50% as compared to the district with JSY coverage 0-10% is 9.6 percentage points higher. The JSY programme is also associated with 6.7 percentage points higher birth in a health facility and 9.1 percentage point higher in a public health facility. Column (5) gives us the impact of JSY expansion on ante-natal care visits. It is seen that there is a negative and significant uptake of ANC visits in the districts with JSY coverage less than 50%, though at higher coverage it becomes insignificant. Here, in column (4) we see a negative impact of JSY coverage on private facility birth, thereby implying that there is a substitution from private to public institutions. Though there is nothing in the programme to induce this behavior. The JSY money can be received even giving birth in recognized private institutes. However, the most positive and significant impact of JSY coverage is on breastfeeding whether within 1 hour or 24 hours. The breastfeeding in areas with JSY coverage more than 50 percent region goes up by 6.4 percentage points compared to the areas with JSY coverage less than 10 percent (base category). Studies (Bhutta ZA et.al, 2008; Jonees G, 2003) have shown that increased counseling about breastfeeding has considerably reduced child mortality. This study as well shows that the with increased JSY coverage there is an increase in breastfeeding immediately after birth this is because the women who deliver in a facility is more likely to receive advice regarding the post-natal care of herself and the baby.

In Table 2.3 (Panel B), shows the point estimates including extensive controls and potential confounders and we did not find much difference (except the magnitude) from the results in Panel A. For example, the likelihood of giving birth in a health facility is 3.2 percentage points higher in a district with JSY coverage >50% as compared to the district with less than 10% coverage (base category). Again, there is a 4.1 percentage points higher likelihood of delivering a baby in the public health facility in the higher JSY coverage district compared to the base category of coverage. The positive impact on breastfeeding is still intact for JSY coverage for more than 50%. There is a 5.4 percentage point higher likelihood of breastfeeding within 24 hours in a district with JSY coverage of more than 50%. Further, the negative impact on private facility birth also remains significant even after we control for all the potential confounders implying that there is a substitution of private for a public facility. The reason for such substitution could not be attributed to the quality of service as to the contrary it is the quality of service which is attributed for women turning away from the public facility (Devasenapathy, N., et. al., 2014). The quality of health facilities is another area which needs to be researched in much detail. It is not only the availability but also the quality that determines if people would prefer to use it or not. However, this thesis does not deal with the quality aspect as it in itself is a research question that needs to be handled in a much elaborate manner. It seems the incentive structure for the community health activist i.e. ASHA, who is responsible for guiding, arranging transport, arranging the institution for the birth, etc., is paid only when the ASHA takes the women to the public health facility.[21] Thus, it is understandable that an ASHA would convince an expecting women to go to a public facility rather than to accredited private facility.

2.8 Falsification test for JSY coverage

Our identification assumption holds that JSY coverage is orthogonal to the error term. Though it is by definition not possible to test this assumption formally, what could be done is to run robustness checks to take care of any concern arising out of the non-random placement of JSY coverage. Pre-trend is the most commonly used tools to check for the existence of any differential trend in the pre-period. This has been done graphically and we do not find any differential trend in the means of the treated and control group in the pre-period. However, to make it more reliable and formal, we examine whether pre-trend differs with future coverage.

The model we use for the falsification test for all the three coverage JSY, ASHA and Sub-centre are given below:

$$Y_{itd} = \beta_0+\beta_1 Time_t+\beta_2 Time\ Coverage_{td}+\beta_3 Time_t Z_d+\beta_4 W_{itd}+\gamma_d+\varepsilon_{itd} \quad \ldots\ldots.. (2.2)$$

Y_{itd} : binary health outcome variables (mortality indicators, health services utilization and breastfeeding) which is only for the pre-period (i.e. till April 2005).

[21] The FAQ on the JSY programme states that "While mother will receive her entitled cash, the scheme does not provide for ASHA package for such pregnant women choosing to deliver in an accredited private institution"

$Coverage_{td}$: we defined the coverage in two ways. In one we used the average coverage of JSY/ASHA/Sub-centre in the entire post-period (i.e. 2006-2011). The other coverage definition is taking the JSY/ASHA/Sub-centre coverage for only one year i.e. 2011 from the post-period.

Time: year of birth of the child

W_{itd}: individual-level covariates (education of mother, age of the mother at the time of birth, the recall period) and dummies (for dwelling, religion, multiple births, and survey rounds).

Z_d: district-level factors like the average wealth at the district level and share of poor and tribal population in the district.

γ_d: district fixed-effects

In table 2.4 we did the falsification test by taking the average JSY coverage for the entire post-period (i.e. 2006-2011) and health outcomes in the pre-period i.e. prior to April 2005. We interact the time variable with JSY coverage variable and found that the coefficient of this interaction term is neither significant in the baseline nor in the full model including all the covariates. The point estimates are almost close to zero. As such we are unable to reject the null hypothesis that there is common pre-trend (β_2 hat=0). Thus, our results are robust for JSY coverage.

Table 2.5 is another falsification test using the coverage data for the year 2011 in the post-period and the health outcomes variable for the pre-April, 2005 period. In this specification as well we find the coefficients of the interaction terms of time with the JSY coverage is insignificant and close to zero. Therefore, we can safely infer that our estimates of JSY coverage on mortality and health service uptake including breastfeeding are robust.

2.9 Test for model specification and additional robustness

In addition, to ascertain the validity of our results and specification, we specified the JSY coverage variable as a continuous variable as well as a binary treatment variable. Table A 2.4 in the model including full controls shows that the JSY coverage as a continuous variable is associated negatively and significantly (at 1% level of significance) with the infant, neonatal, and one-day mortality outcomes. Further, the squared coefficient of the JSY coverage is positive and significant implying that the SC coverage indeed follows a non-linear impact. As such, our specification of non-linear SC coverage is robust. Table A 2.5, provides the estimation of SC coverage as a continuous variable on the health services uptake. Breastfeeding is positively and significantly associated with an increase in JSY coverage. This suggests that as there is an increase in JSY coverage there is a decline in mortality and mothers choose for to breastfeed their baby immediately after the birth within 1hour or 24 hours which is vital for the survival of the baby. Further, in both the specification i.e. the baseline and the full control model we find the squared JSY coverage coefficients to be significant. This implies there is no misspecification of the model with regard to the JSY coverage.

Even when we take the JSY coverage as a binary treatment variable (Table A 2.6 & A 2.7) the point estimates on mortality and health services uptake including breastfeeding does not change the direction or significance.

2.10 Role of the gender of the baby

In the Indian context, there are studies that show differential outcomes for the newborn based on the gender of the newborn (Jayachandran, S. and Pande, R., 2017; Jayachandran, S., 2015). In order to ascertain this claim in our study, we check for any differential impact of SC coverage due to the gender of the newborn baby. In table A 2.8 and A 2.9 we interacted the JSY coverage with the gender of the baby and see if it is significantly different from zero implying if there is addition impact coming due to gender difference of the baby. In both the tables, we have estimated the model with full district and individual level controls. In table A 2.8 we are looking at the impact of gender differentials on the morality outcomes. For the categories of mortality i.e. neonatal, early neonatal and infant mortality we do not find the interaction of the JSY coverage and the gender of the baby to be significant. We also conducted F-test to check for the significance of at least one of the interaction terms.[22] We found coefficients of early neonatal mortality and one-day mortality to have a statistically significant differential impact on mortality based on the gender of the baby. In table A 2.9 also for the skilled birth attendance and health facility birth we do not find the interaction term to be significant. Only for public health facility and for breastfeeding within 24 hours there is some statistical significance at 5% and 1% level of significance, respectively, pointing towards the differential impact of gender. As such we can safely infer that there is no heterogeneous impact due to the gender of the baby. As such, in our specification, we can ignore the gender of the baby as any additional control.

[22] The null hypothesis for the F-test being that the coefficients of all the interaction terms are equal to zero, the alternative hypothesis being at least one of them is not equal zero.

2.11 Discussion

The impact of JSY coverage on mortality is not well documented in the literature either because of insignificant results or because of the faulty identification strategy. The study by Lim, S.S., et. al (2010) used matching, modified before and after design and difference-in-difference analysis. Based on the matching and before and after design, they find a fall in neonatal mortality by 2 to 6 deaths per 1000 live births and did not find significant impact while using the difference-in-difference approach. Powell-Jackson, T. et. al (2015) recognized the problem in the study design of Lim, S.S., et. al study i.e. of reverse-causality in case of individual matching and need of strong assumption of conditional independence in case of modified before and after design. Thus, the best design that is the difference-in-difference method at the district level because it is at this level the policy is implemented. Using the best design neither Lim, S.S., et. al (2010) nor Powell-Jackson, T. et. al (2015) find any significant impact on the neonatal mortality. However, we find a significant reduction in neonatal mortality with an increase in JSY coverage. The direction is similar to the earlier studies mentioned above but importantly it is statistically significant at 1% level of significance and is of higher magnitude. Our estimates show reduced neonatal mortality by the magnitude of 12 to 23 deaths per 1000 live births. Our contribution to the existing literature is, therefore, the reduction in neonatal mortality due to JSY coverage using the best study design in this context that is difference-in-difference at the district level.

On health service utilization, Lim, S.S. et. al (2010) study finds that the JSY programme increased the use of antenatal care visit (at least three visits) by 11 percentage points and increased health facility birth by 44 to 49 percentage points. Powell-Jackson,

T. et. also found an 8.2 percentage points increase in health facility birth, 6.3 percentage points increase in health worker in attendance at the time of delivery, and did not find anything significant on the antenatal care visits. Estimates from this study are closer to the findings of Powell-Jackson, T. et. al (2015) study then to Lim, S.S. et. al. (2010). We find the health facility birth go up 3.2 percentage points, delivery in presence of health worker up by 4.9 percentage points but find no effect on antenatal care for higher coverage. Further, our estimates are close to Powell-Jackson, T. et. al (2015) study in terms of impact on private facility birth and on breastfeeding. Their study finds a decrease private facility birth by 2.2 percentage points and breastfeeding increased by 6.9 to 7.3 percentage points, while we find a 1.8 percentage points reduction private facility birth and increase in breastfeeding by 2.4 to 5.4 percentage points. To conclude, our study using the best design of difference-in-difference in this context finds evidence of the programme's increasing intensity leading to decline in neonatal mortality among other forms of mortality and also find similar estimates with regard to health services uptake including breastfeeding both in terms of direction and magnitude.

Chapter 3

Impact of community health worker (ASHA) on mortality and health services uptake

3.1 Who is an ASHA and what is her role?[23]

An ASHA is a woman community health worker who operates at the village level in India, whose primary responsibility is to spread awareness about government health programmes especially related to the health of women and children. They are an activist in the sense that they go door to door to mobilize people in the village about better health care in terms of hygiene and sanitation. Her role becomes crucial for pregnant women, as she takes care of the women throughout the period of pregnancy. Because of her unique role, an ASHA is known by her name in almost every village by her name![24] The NRHM objective is to have a trained female community health activist (Accredited Social Health Activist, ASHA for short) in every village in the country, each ASHA catering to a population of 1000 people. These ASHA selected from the residents of the village to bring in accountability and she works as an important link between the community and the public health system. An ASHA is a woman who is primarily a resident of the village and preferably aged between 25-45 years old and married/widowed/divorced. The educational qualification is set at up to 10th standard but maybe relaxed if no suitable candidate with this qualification is available. An ASHA is chosen in a rigorous process and their capacity building is a continuously done.[25] They receive an incentive which is performance-based for

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[23] This section draws heavily from the Government of India "About ASHA" information in the Ministry's website. Available at http://164.100.154.238/communitisation/asha/about-asha.html, accessed on 10th July 2019.

[24] I found this during my field interviews with ASHA worker in Odisha, a state in the eastern part of India that people might not know the "Gram Pradhan" the elected representative of the village but they definitely know who is the ASHA for the village and her house. I was guided to many of their houses by kids! Because of her close role especially during the pregnancy of a women she is referred to as "Didi" in Hindi, which literally in English means elder sister! Thus, the people of village share a very close bonding with the ASHA.

[25] The selection process involves various community groups like the self-help groups, Anganwadi institutions, the Block Nodal officer, District Nodal officer, the village health committee and the Gram Sabha

promoting referral and escort services under various healthcare programmes including NRHM and promote universal immunization. She is provided with a drug-kit and is the first point of contact for any health-related issues of the deprived section of the population especially of women and children.

One of her primary roles is to counsel a pregnant woman about the pre and post-natal care that includes briefing them about the importance of safe delivery, the importance of delivering in a health facility, breastfeeding and immunization counseling, and caring of the newborn. Also, they provide information about common infection including Reproductive Tract Infection/Sexually Transmitted Infections (RTIs/STIs). The ASHA mobilizes the community to access the health and health-related services at various levels like Anganwadi/sub-centres/primary health care centres especially the expecting mothers. They motivate the pregnant women to get at least three Ante Natal Check-up (ANC) and for various other Post-Natal Check-up, nutritional and sanitation service that is provided by the government. ASHA's also getting a lot of institutional support in the form of like women's health committee, self-help groups, village health, and sanitation committee (VHSC) of the Gram Panchayat, they are also helped by the Auxiliary Nurse Midwifery (ANM) and Anganwadi workers.

3.2 ASHA coverage

ASHA coverage is a district-level coverage. It refers to the ratio of the number of women who were motivated by ASHA to for Ante Natal Check-up or motivated for health facility delivery to all the deliveries that took place in that district that year. The question asked by in the questionnaire is "Who facilitated or motivated you to avail antenatal care?" or "Who facilitated or motivated you to go to the health facility for delivery?".[26] We tried

[26] Both these questions had a 12 alternatives to be specified, ASHA being one of them. The other 11 were: Doctor, ANM, Health Worker, Anganwadi Worker, NGO/CBO, Husband, Mother-in-law, Mother, Relatives/friends, Self, Others (specify).

to find data on the number of ASHA district wise and for the time period 2001 to 2012 but this data is not available at district level though it is available at State level. This data would have made interpretation better as we could have interpreted the impact on various outcomes of an additional ASHA. As this could not be found at district level we would stick to the ASHA coverage definition i.e. the ratio of the number of women who were motivated by ASHA to for Ante Natal Check-up or motivated for health facility delivery to all the deliveries that took place in that district that year. For the ASHA programme, the high focus states for ASHA is broader than JSY.[27] There are 18 High Focus states for the ASHA programme includes eight Empowered Action Group states, seven North-Eastern states and other states of Sikkim, Himachal Pradesh and Jammu and Kashmir.[28]

This thesis brings out fist evidence in the Indian context about the impact of the information dissemination by the health activists at the village level (known as Accredited Social Health Activist or ASHA for short). The study covers the period from 2002-03 to 2011-12. We have restricted our analysis only to the latest birth of the women. We have checked our estimates including all the live births and the results do not change in terms of direction and significance of our estimates (Table A 3.8 & Table A 3.9). This gives confidence in our estimates and to some extent implies robustness of the same.

The awareness among women regarding ANC and health facility birth saw a gradual take up. In the first financial year 2005-06, only about 10 percent of the districts

[27] The 10 states that are categorized as high focus states (or low performing states) for the JSY programme are also a part of 18 states that has been characterized as high focus for the purpose of implementation of ASHA component of the NRHM.

[28]The eight Empowered Action Group (EAG) states are Uttaranchal (or Uttarakhand), Uttar Pradesh, Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh, Orissa and Rajasthan. The EAG was set up in 2001 with a mandate to facilitate preparation of area-specific programs in these eight States. These states are laggards in terms of containing population growth to manageable levels.

(61 districts) had an ASHA coverage of more than 5 percent. However, over the years this ratio increased for the higher coverage ratio. In the financial year 2011-12, almost 77% of districts (422 districts) had an ASHA coverage of more than 5 percent. In fact, 238 districts recorded more than 20 percent of ASHA coverage. Thus, the coverage of ASHA has been quite rapid as it has increased seven-fold the number of districts under ASHA coverage of more than 5% in seven years (Table 3.1). Though the low focus states did not see the same coverage expansion in terms of the magnitude they do see some increase in coverage. For example, the category of ASHA coverage 5-20% see 15 times increase from 6 districts in 2005/06 to 95 districts in 2011/12. The expansion we do not see in the low focus districts is ASHA coverage over 20 percent. As such, for our analysis, we use all the districts from all the states available in the data set and not restrict ourselves to high vs. low focus states.

3.3 Literature review

The literature on the effectiveness of health worker on mortality outcomes comes from South-Asia and Brazil. Brentani et. al (2016) studied the impact of community health workers (CHW) home visits for pre- and post-natal care under the Family Health Strategy though proposed in 1991 but pursued by the government vigorously in 2000. This study uses individual-level exposure to the programme to determine the efficacy of the program in a region of Sao Paulo municipality in Brazil. Using a logistic regression model with catchment area (region) and time fixed effects found a significant reduction in child and neonatal mortality. A 42% reduction in the odds of child mortality and 82% reduction in odds in terms of neonatal mortality. Macinko J. et. al. (2007) in another study on 557 Brazilian micro-regions over a six-year period using fixed-effect model and found that an increase in Family Health Strategy (FHS) average coverage in Brazil from 14 to 60 percent resulted in a decline of about 13 percent in IMR from 1999 to 2004.

Studies from South Asia (Baqui et. al. 2009; Bhutta et.al., 2011) have found a 40 percent reduction in infant mortality that could be attributed to community-based home visit programs. Bhutta et. al (2011) study was a clustered randomized trial during 2006-2008 in rural Pakistan found on the effectiveness of lady health worker (LHW). The intervention package in the study was the promotion of antenatal care and maternal health education among others and the control group received routine care. Data pertaining to mortality outcomes were conducted by independent data agency that carried out quarterly household surveillance. Even after weak coverage, the study finds a significant reduction in stillbirths and neonatal mortality.

Studies in India has looked into the impact of community mobilization on mortality outcomes and health services utilization.[29] More, N.S., et. al. (2012) in their study on slums in Mumbai (India) using cluster randomized controlled trial of their own community mobilization programme in which a facilitator helped the women's group in having a discussion on issues related to perinatal experience, improving their knowledge and taking local action. The study covered 18,197 births over a three-year period (2006-2009) equally divided into 24 control and intervention settlements each. They found that there is no differential impact of community mobilization on mortality outcomes and health services uptake in terms of uptake of antenatal care, institutional delivery, or breastfeeding behavior, among others. It concludes that there is a need to focus on the

[29] Hurst, Taylor E., et. al (2015) provides a comprehensive literature review on demand-side intervention like community mobilization and financial incentive on health services uptake and mortality outcomes.

poorest of the poor group, taking intensive community activities, and improving quality of health care might bring about visible results on mortality and utilization of health services. In another study, Tripathy, P., et. al. (2010) in a cluster-randomized controlled trial studied the effect of a participatory intervention with women's group on birth outcomes and maternal depression in two relatively poor states in India (Orissa and Jharkhand). Learning from the experience of countries like Nepal's and Bolivia's experience on participatory intervention with women's group, this study evaluates the impact of its programme that assigns its 18 clusters into treatment or control using stratified randomization. The participatory intervention being a facilitator convening on an average 13 groups every month to support participative action and "action cycle" that used to discuss by case studies basis and discussed the problems and solutions with regard to maternal and newborn health care. The study tracks around 19 thousand births over a period of 3 years (2005-2008) and found 32 percent lower neonatal mortality (NNM) in the treated clusters as compared to control. The study also finds some evidence of a reduction in moderate maternal depression in the last year of intervention. It did not find any significant impact on maternal depression for the entire intervention period. These studies on impact of programme on community mobilization are designed by the donor agency and implemented by Non-Governmental Organization (NGOs) in India. These studies cover a very small population that are tightly monitored over a very short period of time. As such, the externa validity of these studies is limited. As opposed to these studies our study evaluates the community health worker (known as ASHA) component of the NRHM programme which was implemented at all India level and the progress of coverage and health outcomes tracked for a decade from 2001/02 to 2011/12.

The model

$$Y_{itd} = \beta_0 + \beta_1 \text{ (ASHA coverage 0-5\%)}_{td} + \beta_2 \text{ (ASHA coverage 5-20\%)}_{td} + \beta_3 \text{ (ASHA coverage >20\%)}_{td} + \beta_4 W_{itd} + \beta_5 \theta_t Z_d + \gamma_d + \delta_t + \varepsilon_{itd} \quad .\ .\ .\ .\ (3.2)$$

Where,

Y_{itd} is the health outcome variables that are broadly categorized into mortality indicators, health services utilization and breastfeeding of the programme. These outcome variables are binary i.e. for example, infant mortality takes the value one if the child dies during the first year of birth and zero otherwise. The same way all other outcome variables are defined.

ASHA Coverage categorical variables:

The base/reference category is ASHA Coverage 0% (i.e. no ASHA coverage at all) to which all other ASHA coverage coefficients are compared to.

ASHA Coverage 0-5%: is a dummy variable which is one of the ASHA coverage is between 0-5% and zero otherwise. Other ASHA coverage i.e. ASHA coverage 5-20% and ASHA coverage >20% are dummy variables defined in the same manner.

W_{itd} refers to the individual level covariates like the education of mother, education of father, age of the mother at the time of birth, the recall period (which is the time gap between year of interview and the year of birth the child), and dummies for place of dwelling (rural-urban), religion (Hindu, Muslim and others), multiple births and for survey rounds.

Z_d represents the district level factors like the average wealth at the district level and share of poor and tribal population in the district.

θ_t refers to the year of birth of the child.

γ_d is the district level fixed-effects

δ_t captures the time fixed-effects

3.4 Main effects: ASHA

3.4.1 Mortality

Table 3.2 shows the estimates from baseline and baseline with all controls specification, Panel A, which is the baseline specification, includes district and year fixed effects whereas, Panel B in addition to the basic specification controls for district characteristics and individual demographics.

In Panel A (Table 3.2), shows that the coverage has a significant negative impact on mortality outcomes whichever way we define it with one-day mortality being negative and significant for all the levels of coverage. It shows that as the coverage of ASHA increases the impact on mortality intensifies implying strong evidence of ASHA coverage on mortality outcomes. Though we do not find any significant impact on infant and neonatal mortality with districts that have an ASHA coverage 5-20%. Starting at ASHA coverage <5%, we find a significant negative impact of JSY coverage on mortality and the impact magnifies with the increase in coverage, which is consistent with the belief that we would expect fewer deaths where there are more presence and activism by the ASHA workers at the village level. Column (1) shows that at ASHA coverage <5% the expansion of ASHA reduces infant mortality by 8 deaths per 1000 live births and the reduction in mortality intensifies to 14 fewer deaths per 1000 last births for the ASHA coverage>20% category. Column (2) shows that at ASHA coverage <5% the expansion of ASHA reduces neo-natal mortality (i.e. mortality within in the first month of the birth) five deaths per 1000 last births and the reduction in mortality intensifies to 13 fewer deaths per 1000 last births for the ASHA coverage of >50%. Column (3), gives the one-day mortality impacts, with an ASHA coverage <5% there are 2 fewer deaths per 1000 live births as compared to the base category of no ASHA coverage. The direction and significance of the impact of ASHA coverage on one-day mortality do not change with the increase in the coverage.

In Panel B of Table 3.2, we show the results including extensive controls for potential confounders and find that the point estimates do not change much in terms of the direction of the effect as compared to Panel A. We find a large negative effect of ASHA coverage on infant mortality, neonatal mortality and one-day mortality. However, the estimates on one-day mortality switches signs once we control for individual and district level covariates. As such, we are not drawing strong causal inference with regard to impact of ASHA on one-day mortality. There might be some unobserved individual or district level factor that is driving this result.

These findings substantiate our hypothesis that the ASHA coverage in terms of ASHA workers motivating the pregnant women to go for ante-natal checkups (ANC) or for health facility birth does indeed help in bringing down the mortality rates in terms of infant mortality, neonatal mortality and one-day mortality. This is crucial in the sense that prior to the launch of ASHA (under NRHM), it seems that pregnant women were not that aware of the importance of the benefits of ANC checkups and birth in a health facility which could be crucial for normal delivery and safe motherhood.

3.4.2 Health services uptake and breastfeeding

Table 3.3 (Panel A) shows the impact of ASHA coverage on health facility birth, public health facility birth and number of ANC visits in the baseline model. It is only at higher ASHA coverage level i.e. ASHA coverage>20 percent that there is some positive impact on health services take up and breastfeeding. Column (3) shows that with increased ASHA coverage, women giving birth in public health facility is positive and significant at higher coverage levels but not at ASHA coverage<5%. Implying that the likelihood of giving birth in a public health facility in a district with ASHA coverage>20% as compared to the district with no ASHA worker is 3.4 percentage points higher. Column (6) shows that the women in the districts with ASHA coverage >20% witnessed a 5.3 percentage point higher breastfeeding within 1 hour of birth compared to the districts with no ASHA coverage.

In Table 3.3 (Panel B), shows the point estimates including extensive controls and potential confounders. After controlling for potential confounders, we found that the point estimates getting better in terms of direction and significance. For example, the likelihood of giving birth in a health facility is 4.7 percentage points higher in a district with ASHA coverage>20% as compared to the district with no ASHA coverage. Again, with ASHA coverage >20 percent, there is a 7.0 percentage point (and 1.8 percentage points higher for ASHA coverage 5-20%) of delivering a baby in the public health facility in the higher

ASHA coverage district compared to the base category of coverage. No matter how the programme was implemented, it results in higher uptake of the health services in the higher coverage districts as compared to the lower ones. The breastfeeding increases among women in the districts with greater ASHA coverage as compared to the base category. This seems to suggest that the ASHA's role is not only important in prenatal care but is also crucial in the post-natal period for safe motherhood and a healthy baby. Bhutta ZA et.al, 2008 and Jonees G, 2003 have shown that increased counseling about breastfeeding reduces child mortality. Given such importance to breastfeeding, the community health workers (CHA) in Brazil were trained intensively on breastfeeding advice given to mothers (i.e. for 20 hrs. as compared to 4 hrs. earlier). Coutinho SB et. al, 2013 analyzed the impact of training on exclusive breastfeeding and found an increase of 13 percentage points with regard to exclusive breastfeeding when the CHA was trained to provide breastfeeding counseling. JSY programme also shows a similar impact on the breastfeeding implying that breastfeeding of babies in the early hours of birth is associated with both counseling done by community health workers (like ASHA) and especially when the delivery takes place in a health facility.

3.5 Falsification test

We did two falsification test to check the validity of our results and we find that our results are robust. In table 3.4 we did the falsification test by taking the average ASHA coverage for the entire post-period (i.e. 2006-2011) and health outcomes in the pre-period i.e. prior to April 2005. We interact the time variable with ASHA coverage variable and found that the coefficient of this interaction term is neither significant in the baseline nor in the full model including all the covariates. Further, the magnitude of the point estimate of the interaction term is close to zero, which is reassuring about the robustness of our estimates. Table 3.5 is another falsification test using the coverage data in only one post-period which is for the calendar year 2011 and the health outcomes variable for the pre-April, 2005 period. In this specification as well we do not find the interaction terms of time with the ASHA coverage to be significant. Thus, we can safely infer that our estimates of ASHA coverage on mortality and health service uptake are robust.

3.6 Test for model specification and additional robustness

In addition, to ascertain the validity of our results and specification, we specified the ASHA coverage variable as a continuous variable as well as a binary treatment variable. Table A 3.1 the model including full controls shows that the ASHA coverage as a continuous variable is negative and significant for early-neonatal mortality and one-day mortality at 10% and 1% level of significance, respectively. Further, the squared coefficient of the coverage is positive and significant implying that the ASHA coverage indeed follows a non-linear impact. As such, our specification of non-linear AHSA coverage is robust. This claim is further strengthened when we see the results in the A 3.2 table, which provides the estimation of ASHA coverage on the health services uptake. A continuous ASHA coverage also in the model with full controls specifies a positive and significant impact of ASHA coverage on all the components of health service uptake including breastfeeding. These results suggest that as there is an increase in ASHA coverage there is a decline in mortality and pregnant women are choosing to deliver in the presence of a skilled birth attendant, in a health facility, increase their ANC visits and also shows an increase in women breastfeeding within the first hour and the first day of the birth. Further, in both the specification i.e. the baseline and the full control model we find the squared ASHA coverage coefficients to be significant. This implies that our non-linear specification of the ASHA coverage is rightly specified.

3.7 Role of the gender of the baby

There are studies that look into the differential impact of coverage depending on the gender of the baby. In order to ascertain this claim in our study, we check for any differential impact of ASHA coverage due to the gender of the newborn baby. In Table A 3.5 and A 3.6, we interact the ASHA coverage with the gender of the baby and see if is significantly different from zero implying if there is addition impact coming due to gender difference of the baby. In both the tables, we have estimated the model with full district and individual level controls. In table A 3.5 we are looking at the impact of gender differentials on the morality outcomes. For all the categories of mortality i.e. neonatal, one-day, early neonatal and infant mortality we do not find most of the interaction of the ASHA coverage and the gender of the baby to be significant. However, to ascertain if all the interaction terms are statistically different from zero or not, we performed F-test and found that infant mortality is not but for neonatal and one-day mortality the gender of the newborn does play a differential impact. As such we can infer that though there are some statistically significant results with respect to ASHA coverage affecting the health outcomes differentially by gender of the baby the magnitude is not huge. It may also be noted that the impact on the mortality of boys is larger because biologically the mortality rate of boys is higher. However, United Nations (2011) in its study found that “in India, female infant mortality was slightly higher than male infant mortality, but girls’ survival disadvantage was particularly acute in the 1-4 age group". It seems that though nature has its way in terms of higher survival probability of a girl child with differential care for the newborn based on the gender might actually dent the biological advantage to the extent that girl's survival rate declines. However, these differential impacts are to be interpreted cautiously.

Table A 3.6 shows that using F-test and corresponding p-values the decision of the mother for choosing to deliver in the presence of a health professional or delivery at a health facility is affected by the gender of the baby. However, there is no differential impact of the gender of the baby on the mother's decision about ante-natal care services, public or private facility birth or breastfeeding behavior.

3.8 Discussion

Though not strictly comparable to the Brentani et. al. (2016) study, the direction of impact of ASHA on infant and neonatal mortality is same that is a reduction in neonatal and infant mortality with the increase in coverage of community workers. Our estimates show a reduction in 6 to11 neonatal deaths and 8 to 10 infant deaths per 1000 live births compared to no ASHA coverage districts (reference category). This is equivalent to a 16 to 36 percentage reduction for neonatal deaths and 27 to 36 percentage reduction for infant deaths over a period of 2005 to 2012, during which the coverage increased from 46 percent to 90 percent, comparable to Macinko J. et. al. (2007) findings of an increase in Family Health Strategy (FHS) average coverage in Brazil from 14 to 60 percent leading to a decline of about 13 percent in IMR from 1999 to 2004.

Chapter 4

Impact of physical health infrastructure (Sub-Centre) on mortality and health services uptake

4.1. Background

The Sub-centre coverage is one of the three main components of the National Rural Health Mission (NRHM). Access to basic health care institution can impact the health outcomes in a significant manner. This is more so in the rural areas and not so easily accessible regions. The first point of contact of any form of institutionalized medical advice comes from the lowest level medical facility created by the Government. In the Indian scenario, this is a Sub-centre at the village level. It is a bridge between the community and the primary health care centre. As such any shortfall in the availability of such basic health care facility is bound to have an adverse effect on the health outcome of the people. According to the government's estimate and going by population census of 2001 and adhering to the population criteria for the availability of the sub-centre i.e. 1 per 5000 population in general areas and 1 per 3000 population in the tribal areas, the shortfall of Sub-centres in the year 2005 was to the tune of 21,983 (of the total requirement of 1,58,702 Sub-centres). Of which, only 63,800 were operating from government buildings. After adjusting for the buildings that were operating from Panchayat and other voluntary society buildings, the amount of shortfall was estimated at a staggering 59,226. Such glaring shortfall can hinder in proper provisioning of quality health care at the village level. To understand the importance of the sub-centre in the public health system in India we may look at the structure of the public health system in India. The public health care system in India has a three-tier system as shown in Graph 4.1.

The sub-center strengthening or establishing was one of the key mission activity and objective. The framework for implementation (GoI, 2008) of the progamme states that the new sub-centre building should be of the area around 500 square feet and to have a staff quarter for the Auxiliary Nurse Midwife (ANM). The national government provides 75% of the funding for the total amount required for the construction of the sub-centre during the mission period (2005-2012). However, the targeting done by the centre is based on the requirements and shortfalls implying that the states which have a higher shortfall of the availability of sub-centre will get more support in terms of funding from the central government vis-à-vis the states that are doing relatively better.

The primary health care issues are addressed by the sub-centres (SC) and the primary health care centres (PHC), the secondary health care is taken care at the community health care centres (CHC) and district hospitals. Finally, the complicated and specialized procedures are done in the tertiary medical centres i.e. medical colleges and apex centres. These colleges/apex centers are not available in every district. There are a few in every state. The three layers of medical institutions provide different types of services like primary health care provides mostly preventive services. In addition, it also provides some elementary curative services and promotes a healthy lifestyle. The secondary health care system concentrates mostly provide curative and specialized health care services. The super-specialized and complex treatment is left to the tertiary health care service provider like the medical colleges.

Manang, F. and Yamauchi, C. (Forthcoming) using longitudinal data found that the new health facilities do affect the take-up of health services like an increase in the probability of antenatal care visit at the lower level public health facility. This paper also documents the existing literature on this area. Most of the studies from the developed countries focus on the negative impact of closures or consolidation of health facilities and/or increase in travel time to the health facilities. The studies pertaining to the developing countries are limited to the extent that the focus has been limited to impact on maternal health and looks into the impact of having midwives at the lowest level of health care provisioning i.e. village level (Franenberg et.al, 2009; Joshi and Schultz, 2007; Chaudhuri, 2008; Fauveau et al., 1991). Our study provides evidence that there is a negative impact on infant and neonatal mortality with the increased access to the basic health care facility in the form of availability of a sub-centre in the locality. We also find that there is a positive impact on skilled birth attendance by increasing the availability of such health care facility at the village level. Studies (Sabina and Oona, 2009; Thaddeus and Maine, 1994) have found in the African context that there is an underutilization of skilled birth attendance due to lack of physical accessibility of health care facilities. As such our study provides new evidence from with regard to the impact of accessibility of basic health care facilities on mortality in developing country and is in line with the existing literature that finds increased accessibility leading to better skilled birth attendance.

4.2. Data

We are using pooled cross-section data from three rounds of district-level household and facility survey (DLHS) conducted by International Institute for Population Sciences (IIPS), Mumbai at three intervals i.e. at DLHS-2 (2002-04), DLHS-3(2005-08) and DLHS-4 (2010-12). The Ministry of Health and Family Welfare (MoHFW), Government of India has designated this institution as the nodal agency for carrying out the household as well as the facility survey. IIPS has been assigned to design and develop survey tools and software, train manpower, and carry out the fieldwork with regard to these surveys. We use DLHS-2, DLHS-3, and DLHS-4 for health outcomes like an infant and neonatal mortality and also the health service uptake like ante-natal care visit and delivery in a health facility or delivery performed in the presence of a skilled birth attendance. In addition, we use DLHS-4 facility survey for the purpose of coverage of sub-centre. The facility survey among other things is carried out to assess the quality of services provided, physical infrastructure, and staff strength at various levels of the health care provisioning i.e. at the and the district hospital (DH), community health centres (CHC), primary health centre (PHC) and the sub-centres (SC).

In the DLHS-4 facility survey, from each district, about 40, 50, 60 or 70 primary sampling unit (PSUs) are selected by using PPS (Probability Proportion to Size) systematic sampling method. A primary sampling unit in this survey is a village. The selected village (PSU) is definitely under the jurisdiction of one Sub-Center. That Sub-Center will be identified and will be covered for the survey. Similarly, we can move up in the ladder and see which PHC caters to this Sub-Centre. Upon identification of that PHC, it will be covered for the survey. For the purpose of this survey, all the CHCs and District hospital is covered in the facility survey.

We use the data for sub-centre only to look at the impact of the expansion of the most basic health facility in the form of sub-centres at the grass-root level in the villages. The sub-centre premise being created or expanded brings the medical facility closer to the people especially in the rural areas is likely to reduce the time and cost of getting medical opinion especially in the cases of pre and post-natal care among pregnant women. This is critical as timely advice and elementary care can prevent untimely mortality among the infants. Though sub-centre does not have a trained medical doctor it has an Auxiliary Nurse Midwife and one to two ASHA workers and in some cases a male attendant. Even though the sub-centre would not be able to handle complicated cases, timely antenatal checkup and medical advice at sub-centre can prevent complication in the first place i.e. nipping the problem in the bud.

4.3. Sub-centre coverage

In this chapter, we refer to Sub-centre coverage refers to the ratio of the total number of Sub-centre available in a district at the time “t” (i.e. the stock of SC at time “t”) to the total population of the sampled village (PSU). This ratio is multiplied by 10,000 to get per 10,000 population availability of Sub-centre. Here year refers to a calendar year from 1st January to 31st December. The question asked in the facility survey is “Since when this Sub- Centre is functioning from this building?”. As this question only elicits a response in terms of the year and not the month from when it began its operation, we are able to track the coverage in terms of the calendar year and not the financial year.

The physical health infrastructure expansion is measured here per ten thousand people. The four categories of 0-0.5, 0.5-1, 1-1.5 and 1.5 and more is done on the basis of how much population the SC needs to serve by IPHS (Indian Public Health Standard). By the criteria of population, there has to be one Sub-centre is established for every 5000 populations in plain areas and for every 3000 population in hilly/tribal/desert Areas (GoI, 2006). Therefore, 0.5 per 10,000 implies there is one per 20,000 and 1.5 per 10,000 implies that there is one per 6666 people approximately and more than 2 implies one per 5000 people.

Table 4.1 gives the coverage of the sub-centres by years beginning from 2001 till 2012. In 2001, 332 districts out of 542 districts had some Sub-Centre facility (i.e. 61% of the total no. of districts) and rest 39% of the districts (210 districts) has access to more than one more Sub-Centre. In 2005, the year of the launch of the National Rural Health Mission Programme, the access to one or more Sub-Centre increases to 48% (recording a 9% increase since 2001). Since physical infrastructure expansion takes time we track the expansion for subsequent years until 2012.[30] Keeping in view the time lag that of taking a policy decision and actually building physical infrastructure at the village level, the Government of India had set targets accordingly for such expansion. Government of India had set a timeline for strengthening/establishing Sub Health Centres as per IPHS, in 1, 75000 places to be completed by 30% by 2007, 60% by 2009 and 100% by 2010.

As per IPHS, the one sub-centre should cater to 5000 population. In 2004, the sampled population of 241 districts (44% of the total number of districts surveyed) had access to one or more Sub-Centre. With the launch of NRHM, the coverage increased to 311 districts in 2007 (57%), an increase of 13% within 2 years. In 2012, the coverage increased to 87% as compared to 44% in 2004, implying a doubling of coverage in a span of 8 years! This is comparable to the study of Manang, F. and Yamauchi, C. (Forthcoming) where they find that the average number of lower-level facilities per 'parish' doubled from 0.2 in 2002 to 0.4 in 2012.

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[30] Government of India specifies extended timelines for physical infrastructure expansion. Most of the targets for health infrastructure has 2010-11 as the timeline. The timeline for ASHA and JSY component are earlier when compared to sub-centre and understandably so.

The model

$$Y_{itd} = \beta_0 + \beta_1 \text{ (SC coverage 0.5-1)}_{td} + \beta_2 \text{ (SC coverage 1-1.5)}_{td} + \beta_3 \text{ (SC coverage >1.5\%)}_{td} + \beta_4 W_{itd} + \beta_5 \theta_t Z_d + \gamma_d + \delta_t + \varepsilon_{itd} \quad .\ .\ .\ .\ (3.1)$$

Where,

Y_{itd} is the health outcome variables that are broadly categorized into mortality indicators, health services utilization and breastfeeding of the programme. These outcome variables are binary i.e. for example, infant mortality takes the value one if the child dies during the first year of birth and zero otherwise. The same way all other outcome variables are defined.

SC Coverage categorical variables:

The base/reference category is SC Coverage 0-0.5% to which all other SC coverage coefficients are compared to.

SC Coverage 0.5-1: is a dummy variable which is one of the SC coverage is between 0.5-1 and zero otherwise. Other SC coverage i.e. SC coverage 1-1.5 and SC coverage >1.5 are dummy variables defined in the same manner.

W_{itd} refers to the individual level covariates like the education of mother, education of father, age of the mother at the time of birth, the recall period (which is the time gap between year of interview and the year of birth the child), and dummies for place of dwelling (rural-urban), religion (Hindu, Muslim and others), multiple births and for survey rounds.

Z_d represents the district level factors like the average wealth at the district level and share of poor and tribal population in the district.

θ_t refers to the year of birth of the child.

γ_d is the district level fixed-effects

δ_t captures the time fixed-effects

4.4. Main effects: Sub-Centre

4.4.1. Mortality

In Table 4.2 we have shown the association of Sub-centre coverage with mortality. In panel A, the estimated baseline model shows that there is a significant negative impact on mortality with the increasing Sub-centre coverage. There is a decline in neonatal mortality in the districts with SC coverage of more than 1.5 by 31 deaths per thousand live births as compared to the base category of districts with coverage less than 0.5. For the same level of coverage, it can be seen that there is a decline of 3 per thousand live birth for early neonatal mortality and 3.6 per thousand live birth for one-day mortality. By including all the controls i.e., the district level covariates and individual covariates we get point estimates which are reported in the Panel B. The direction and significance of the estimate do not change. However, the magnitude goes down a bit. There is a negative and significant effect of 21 fewer deaths per 1000 live births (i.e. IMR) in the districts with sub-centre coverage of 0.5-1 as compared to the district with sub-centre coverage less than 0.5 (base category). Similarly, for the same level of coverage, there is a decline in deaths by 27 deaths per 1000 live births (or decline of 2.7 percentage points) in neo-natal mortality as compared to the base category. The magnitude of the decline in morality a lesser in case of one-day mortality and early neonatal mortality because the levels of these mortality outcomes were already low at the baseline compared to other mortality outcomes such as infant mortality). However, the impact is negative and highly significant as the sub-centre coverage increases.

4.4.2. Health services utilization

Table 4.3 provides the mechanism through which such a decline in the mortality is made possible. There is a positive and significant impact of sub-centre coverage on health worker in attendance at delivery and breastfeeding. Panel A gives the estimates of the baseline model, the pregnant women in the districts with SC coverage of 1.5 or more show a 5.9 percentage points higher uptake of health worker attendance during their delivery as compared to the base category of SC coverage of 0.5 or less. Even when we control for all the confounders we still find a 4.1 percentage point higher uptake of health worker attendance for women in the higher coverage districts compared to the lowest category. We do not find any association between the SC coverage and the ANC visits. However, for both the baseline and the model including all controls, as the SC coverage increases, there is an increase in the breastfeeding within 24 hours. This is a positive impact as studies have shown that increased breastfeeding in the initial period of childbirth helps reduce neonatal and infant mortality significantly. In the baseline model, we also found that women in the districts with higher SC coverage as compared to the base category preferred to go for delivery in a health facility.

4.5. Falsification test

The robustness of our estimates is evident from the fact that in most of the cases we do not see much change in the direction or significance of the coefficients in the baseline and the model that includes all the controls. However, we did many falsification tests to check the validity of our results and we find that our results are robust. In table 4.4 we did the falsification test by taking the average SC coverage for the entire post-period (i.e. 2006-2011) and health outcomes in the pre-period i.e. prior to April 2005. We interact the time variable with SC coverage variable and found that the coefficient of this interaction term is neither significant in the baseline nor in the full model including all the covariates. Table 4.5 is another falsification test using the coverage data in only one post-period which is for the calendar year 2011 and the health outcomes variable for the pre-April, 2005 period. In this specification as well we do not find the interaction terms of time with the sub-centre to be significant as such we can safely infer that our estimates of SC coverage on mortality and health service uptake are robust.

4.6. Test for model specification and additional robustness

In addition, to ascertain the validity of our results and specification, we specified the SC coverage variable as a continuous variable as well as a binary treatment variable. Table A 4.1 in the model including full controls shows that the SC coverage as a continuous variable is negative and significant at 5% for one-day morality outcomes and at 10% for early neonatal mortality reduction. Further, the squared coefficient of the coverage is positive and significant implying that the SC coverage indeed follows a non-linear impact. As such, our specification of non-linear SC coverage is robust. This claim is further strengthened when we see the results in the A 4.2 table, which provides the estimation of SC coverage on the health services uptake. A continuous SC coverage also in the model with full controls specifies a positive and significant impact of SC coverage on the health worker attendance during pregnancy and increased ANC visits and breastfeeding. These suggest that as there is an incremental SC coverage there is a decline in mortality and increase in mothers to choose for delivery in the presence of a skilled birth attendant and are also more keen on increasing breastfeeding their newborn babies which is vital for their survival. Further, in both the specification i.e. the baseline and the full control model we find the squared SC coverage coefficients to be significant. This implies that our non-linear specification of the SC coverage is rightly specified.

4.7. Role of the gender of the baby

There are studies that look into the differential impact of coverage depending on the gender of the baby. In order to ascertain this claim in our study, we check for any differential impact of SC coverage due to the gender of the newborn baby. In table A 4.5 and table A 4.6 we interact the SC coverage with the gender of the baby and see if is significantly different from zero implying if there is addition impact coming due to gender difference of the baby. In both the tables, we have estimated the model with full district and individual level controls. In table A 4.5 we are looking at the impact of gender differentials on the morality outcomes. For all the categories of mortality i.e. neonatal, one-day, early neonatal and infant mortality we do not find the interaction of the SC coverage and the gender of the baby to be significant. Further, we ran the F-test and found that we cannot reject the null hypothesis that all the interaction between gender and SC coverage is indeed zero. As such we can safely infer that there is no gender differential impact is coming up in our estimates. Therefore, in our specification, we can ignore the gender of the baby as any additional control.

Table A 4.6 further strengthens our argument that the gender of the baby has no role to play whatsoever in the decision of the mother taking medical advice from the health workers in the ANC visits. This is because the table shows that none of the interaction terms i.e. interaction of the SC coverage with the gender of the baby is significant. Thus, the additional impact of being a boy a girl does not influence the women's decision to about her natal health care service preferences. However, we computed the F-test and corresponding p-values for public facility birth and private facility birth showing that there is a differential impact of the gender of the baby on these outcomes. Though statistically significant, we cannot make out much about the significance of these differential impact in an economic sense.

4.8. Discussion

In this chapter, we have looked into the impact on mortality, health care uptake and breastfeeding behavior of the mother due to increase in coverage of community health worker coverage (ASHA) and access to first level health care facility (sub-centre). In this study, we find that an increase in access to health care facility by way of increase in sub-centre coverage leads to increased take-up of delivery in the presence of skilled health personnel and also increasing immediate breastfeeding of the newborn baby. There is a 3.5 to 6.5 percentage point increase in take-up of skilled birth attendance delivery with more SC coverage comparable to 5 to 7 percentage point increase in the probability of skilled birth attendance in a facility found for an additional higher-level facility found by Manang, F. and Yamauchi, C. (Forthcoming) using linear probability model with regional (sub-county) and mother fixed effects. Though in our study sub-centre is essentially a lower-level health facility. Manang, F. and Yamauchi, C. (Forthcoming) found improved access promotes antenatal care at a lower level facility with mother fixed effects which is comparable to our estimates of antenatal care for the sub-centre though not significant. However, we find improved breastfeeding in the early hours after birth with increased sub-centre coverage, which seems to be coming from greater interaction and exposure with the health personnel posted in the sub-centre, the first point of contact for the community of any form of health services, especially in rural India. We have not dealt in this study the travel mode, time and expense. As under the NRHM, there is the provisioning of free transportation to the public health facility. Additionally, our dataset does not have a unique identification code below the district level. However, we estimated the impact of the sub-centre coverage on the mortality outcomes. Our study finds that there is a significant reduction in neonatal mortality by 2.7 to 4.2 percentage points and infant mortality by 2.2 to 3.6 percentage points. Though, Manang, F., and Yamauchi, C. (Forthcoming) because of the limitation of their data did not estimate the impact on the mortality indicators like maternal and infant mortality but estimated child health outcomes through complication during delivery and birth weight. Their results were not conclusive with regard to improvement in health outcomes and owing to small sample size refrained from claiming that there is no impact of access on health facilities on maternal and child health outcomes.

Chapter 5

Interactions of components of the NRHM

5.1. Introduction

In the previous two chapters, we have analyzed the results pertaining to each of the proramme separately. The coverage of the three key components of the NRHM (JSY, ASHA, and physical infrastructure expansion) over the mission period has been different. It is primarily because of the inherent nature of the components itself. Providing money to the women who come for giving birth in a public facility requires only budgetary allocation and some awareness. As such, it is not strange that this component of the programme picks up earlier than others (i.e. in 2008-09). Though delayed but still better than other components. Recruiting ASHA workers, training them in the basic modules of natal care and immunization does take more time than budgetary provisioning.[31] Further, the ASHA themselves getting into the groove of the job and actually having an impact on health outcomes is another factor leading to the delayed take up of their services by the populace. We, therefore, see this component take off at a later period as compared to JSY i.e. in 2009-10. And finally, the expansion of the physical infrastructure, in this study we restrict it to building up of new sub-centre or upgrading the existing ones, though the programme also takes into account the expansion of the higher-level health care facilities like PHC, CHC and district hospital. Comparing the expansion of sub-centre to the other two components of JSY and ASHA, we expected that sub-centre will show a much-delayed take off because of the nature of the component itself. It is natural to expect that

[31] There are 7 modules on which the ASHA workers have to be trained, the first two of them being the essential ones.

it takes a lot of time, money and effort to build new buildings, equipping them with adequate manpower and other medical equipment.

5.2. Discussion on the various coverage interaction

In that background, it is quite intriguing to look at the interactive effect of these components on various health outcomes like mortality, services uptake like taking up skilled birth attendance and on behavioral changes with regard to increasing breastfeeding on the advice of the community health worker like ASHA. In this short chapter, we will look at all the three components taken together as dichotomous variables and see each of their impacts separately on mortality and the health service uptake. Finally, we will look into the interactive effect of various possible combinations of the components and all of them as a separate interactive variable. This will disentangle the individual effect of each of the component and any additional impact of one in the presence of the second or all the others. This completes our analysis in a holistic manner, as we are not only looking at the individual effect separately, but we are also looking at the individual effect when all of the components taken together and also analyzing the effect of a combination of the components and in the end all of them together.

The model with all the three coverage variables as binary variables is given below. The model with interaction is just an extension of the model below, the addition being it includes the interactions between the coverage variables everything else remaining the same.

$$Y_{itd} = \beta_0 + \beta_1 JSY_{td} + \beta_2 ASHA_{td} + \beta_3 SC_{td} + \beta_4 W_{itd} + \beta_5 \theta_t Z_d + \gamma_d + \delta_t + \varepsilon_{itd} \quad \ldots\ldots (4.1)$$

Where,

Y_{itd} is the health outcome variables that are broadly categorized into mortality indicators, health services utilization and breastfeeding of the programme. These outcome variables are binary i.e. for example, infant mortality takes the value one if the child dies during the first year of birth and zero otherwise. The same way all other outcome variables are defined.

JSY_{td} is a binary coverage variable that takes the value one if the JSY coverage is greater than 10 percent.

$ASHA_{td}$ is a binary coverage variable that takes the value one if the ASHA coverage is more than zero.

SC_{td} is a binary coverage variable that takes the value one if the Sub-centre coverage is more than 0.5.

W_{itd} refers to the individual level covariates like the education of mother, education of father, age of the mother at the time of birth, the recall period (which is the time gap between year of interview and the year of birth the child), and dummies for place of dwelling (rural-urban), religion (Hindu, Muslim and others), multiple births and for survey rounds.

Z_d represents the district level factors like the average wealth at the district level and share of poor and tribal population in the district.

θ_t refers to the year of birth of the child.

γ_d is the district level fixed-effects

δ_t captures the time fixed-effects

In table 5.1 we estimate our model with all the three components as a dichotomous variable. The dummy takes the value one if the JSY coverage is more than 10%, ASHA coverage more than zero and SC coverage more than 0.5. The JSY coverage is negative and significant and infers that infant mortality in the districts is 1.2 percentage points lower compared to the base category which in this case infant mortality in a district with JSY coverage of less than 10% and no ASHA coverage and SC coverage of less than 0.5. Interestingly if we compare this estimate of with the estimate we got by taking JSY coverage alone as a binary variable and we found that there is a 1.3 percentage points lower infant mortality as compared to the base category of the JSY coverage less than 10%. Thus, we can see even when we add the other two coverage i.e. ASHA and SC coverage we still get the impact of mortality of the JSY coverage undiluted, which adds to our robustness claim of the results. The results of the neonatal mortality also survive.

The districts with some ASHA coverage witness a 0.84 percentage points lower infant mortality as compared to districts with no ASHA coverage and JSY coverage of less than 10% and SC coverage less than 0.5. This point estimate is very close to what we get in the ASHA binary treatment regression, which shows 0.89 percentage points lower infant mortality. In the model with all other coverages, the one-day mortality in the district with some ASHA coverage is lower by 0.15 percentage points as compared to a district with no ASHA coverage and JSY coverage of less than 10% and SC coverage of less than 0.5. This is the same magnitude which we got when we used the ASHA coverage alone as the explanatory variable.

Further, the districts with SC coverage of more than 0.5 has an infant mortality rate of lower by 2.1 percentage points as compared to the base category of districts with SC coverage of less than 0.5, no ASHA coverage and JSY coverage of less than 10%.

Table 5.2 shows the association of all the three coverage taken together in the estimation and its impact on the various health services uptake. We find that the ASHA coverage and the SC coverage are positively and significantly affect the breastfeeding behavior of the mother within 1hr and 24 hr. of birth of the child. Especially districts with some ASHA coverage has positive and significant on breastfeeding. We also see some degree of substitution of private to public facility birth. The districts with some ASHA coverage see the substitution of private for the public as the preference for private facility declines by 1.1 percentage points and public facility go up by 0.9 percentage points as compared to districts with not ASHA coverage and JSY coverage less than 10% and SC coverage less than 0.5.

Finally, in Table 5.3, we take all the coverage variables together in the same regression to see the independent impact and also the additional impact of each additional coverage that we interact with each other. We interact with each coverage with the other coverage variable and finally, we interact all of them together. It is quite clear that there is a significant negative impact of JSY and SC coverage on all forms of mortality and ASHA coverage has the same for one-day mortality. The interaction terms we consider here is between JSY and SC coverage, ASHA, and SC coverage and JSY and ASHA coverage and finally all the coverage i.e. JSY, ASHA and SC coverage together.

The only interaction term that comes out significant is the JSY and SC interaction term. The positive and significant coefficient of the coverage interaction implies that there is a substitution of components. It implies that presence of either one of the components of the NRHM either in the form of JSY coverage or SC coverage is enough to reduce mortality in terms of infant, neonatal, early neonatal, or one-day mortality. It is interesting to see that it leads to policy implication of such a finding could be. In the short run, the government might financially incentivize mothers to go for health facility birth but it might not be sustainable in the long run. As such, in the long term, it is better to build health facility and increase the access of health facility to the people which can then reduce the child morbidity.

None of the other interactions terms show any significant effect on mortality. The triple interaction term i.e. interaction of ASHA, JSY and SC coverage is also not significant. In order to ascertain if any of these interaction terms are significantly different from zero, we ran an F-test for all the interaction terms taken together. We estimate the F-value and corresponding p-value for all the mortality indicators. The infant mortality and neonatal mortality show an F-value of greater than three indicating that at least one of the interaction term is significantly different from zero. The corresponding p-values show that in the regressions for infant mortality and neonatal mortality, at least one of the interaction terms is significant at 5% level of significance.

5.3. A preliminary cost-benefit evaluation of the programme

According to our calculation in the financial year 2010-11 about 412 thousand women benefitted from the JSY conditional cash transfer.[32] Also, about 405 thousand women were motivated by the community health worker (ASHA) for health facility

[32] This may be underestimated as we are relying on the sampled population from the DLHS Survey data.

delivery. On the cost side the Government of India spent Rs. 1777 Crores (USD 273 million) in the year 2014-15.[33] On ASHA, the expenditure was about Rs. 476 Crores (USD 73 million) in the year 2010-1.[34] The cost of additional health facility birth in terms of JSY component is USD 662 and for ASHA it is USD 180. The combined costs for the JSY and ASHA component is USD 844. With regard to the benefits, Fink (2014) has estimated at USD 5000 per life year saved.[35] Benefit to cost ratio works out to be around 5.9.[36] This cost-benefit is very conservative and has a downward bias as we are using the sampled population only. The actual beneficiary would be more than what we have in the sample survey. Further, it is difficult to impute the indirect benefits of a life saved which could be cost of another pregnancy. As such, the per capita cost here is overestimated and thus the benefit-to-cost ratio under-estimated. Regardless of that the underestimation, the benefits outweigh the costs associated with the programme.

[33] Government of India, Ministry of Health and Family Welfare, Department of Health and Family Welfare, Lok Sabha Unstarred Question No. 2008, answered on 29th December, 2017 on Janani Suraksha Yojana.

[34] Update on ASHA programme (2013), NHSRC, available at http://nhsrcindia.org/sites/default/files/Update%20on%20ASHA%20Program%20July%202013.pdf

[35] Fink (2014) suggests that this is reasonable given that the average GDP per capita in low and middle income countries today is US$ 4500.

[36] Fink (2014) found reduction of neonatal mortality by 70% (2013-2030) has a likely benefit-to-cost ratio of 11.7 to 18.2

Chapter 6

Conclusion

The general election of India in the year 2004 and focus of health issue on the agenda of the party that ultimately won the election (Indian National Congress) helped bring in fundamental changes in the health sector. The MDGs targets, India's bad health indicators as compared to other developing countries and sub-Saharan countries, and 'political will' to go for a complete overhaul of the system created a fertile ground for the germination of a nationwide programme called National Rural Health Mission (NRHM) in April, 2005 in a mission mode till 2012. The programme has been so successful that another branch of the programme called National Urban Health Mission has been started since 2013. NRHM and NRUM come under the umbrella of the National Health Mission (NHM) now.[37] Further, usage of services of traditional healers by women has reduced after the introduction of the programme providing validity to the increased uptake of health services with wider coverage of JSY, ASHA, and Sub-centre.[38]

In this thesis, we have evaluated the impact of three major components of National Rural Health Mission (NRHM) which are providing a financial incentive for institutional

[37] Though detailed empirical analysis of the success is limited only to the JSY programme (Lim et. al. 2010 and Powell-Jackson et. al 2015). As per our knowledge, other claims of success are primarily based on incremental progress measured by increase in number of ASHA and number of sub-centre over the years. No rigorous effort has been made to look into the causal impact of such expansion on the health outcomes.

[38] The percentage of women who have sought any treatment from the traditional healers with regard to problem in conceiving have come down from 22.5 per cent in 2005 to 17.8 per cent in 2008. This is based on the data from DLHS-3. 13,125 women who answered the question about whether they sought any treatment from traditional healer and when grouped by the year, we find that 2680 had actually got some kind of treatment from the healers. On tracing these women year-by-year, we found that the percentage of women seeking treatment from traditional healers for their problems in conceiving have been 20.7% in 2004, 22.5% in 2005, 22% in 2006, 18.6% in 2007, 17.8% in 2008. Thus, the NRHM seems to have channelized women towards availing professional medical advice, which is welcome change in behavior and has positive ramification for health outcomes.

delivery (JSY), spreading awareness about pre- and post-natal care (ASHA) and physical infrastructure expansion (building new sub-centres). We also explored the interlinkages between them. We used the difference-in-difference identification strategy to identify the causal link. We checked for our model specification and found that non-linear coverage best fits the model. Therefore, we have a non-linear specification for coverage variable.

6.1. Research objectives and main findings

The research objectives of this thesis are the to evaluate the impact of access to health facility (SC), conditional cash transfer for institutional delivery (JSY) and awareness creation by a community health worker (ASHA) on the mortality and health services utilization outcomes. The study also tried to explore interlinkages between the supply and the demand side of health care provisioning.

Our main findings are that all the three coverage i.e. JSY, ASHA, and Sub-centre expansion has a significant negative impact on the infant, neonatal and one-day mortality. The magnitude of such impact increases with an increase in programme intensity in terms of coverage. The study also looked into the impact of coverage on the health services utilization and breastfeeding during early hours of birth and found that all the coverages have a positive and significant impact on health facility birth, skilled birth attendance and breastfeeding in early hours of birth. This actually shows the mechanism through which reduction in mortality was achieved. That is as the coverage of all the three components increased it leads to higher take up of health facility birth, skilled birth attendance and increased breastfeeding which in turn reduces mortality.

To be sure about our findings, we ran numerous robustness checks and falsification test and have found our results to be robust. The most widely and generally accepted checks in a difference-in-difference analysis are the common trend check. We ran the pre-trend check with two different specifications of coverage and found that there is no differential trend existing before the launch of the programme. Meaning we could not reject the common trend assumption. Also, we used data for last birth and for all live birth and we did not find any significant difference in the point estimates. The study also explored the possibility of differential effect based on the gender of the birth but we did find some statistically significant differential impact for ASHA and JSY programmes but the magnitude is small and may not have much economically meaningful interpretation. We also specified the coverage variables as a continuous variable and also as a dichotomous variable and still we find our main results to be intact which is a reduction in mortality and higher uptake of health care services and increase in breastfeeding in early hours after birth. Last but not least, to allay any fear of endogeneity arising from one component on others, we estimate the point estimates by taking all the coverages together. It is reassuring that our estimates on the infant, neonatal and one-day mortality survive for all the NRHM components coverage. This study also finds demand-supply interlinkages as the supply side physical expansion through the expansion of SC and the demand for institutional delivery as a response to governments financial incentive (JSY) is found to be working as a substitute.

6.2. Policy implications

Given the success of the programme, the budgetary allocation for the National Health Programme should be increased by the central government as well as the state government. This will increase public expenditure on health which is very much needed to reduce the out-of-pocket expenditure by the people, which constitutes the majority of the expenditure in the health sector. Another interesting finding of this study is that the health infrastructure and financial incentive work as a substitute. This implies that government in the short-run can induce institutional delivery by financially incentivizing birth at the health facility and in the long-run, it can focus on increasing both the quantity and quality of the basic health facility at the village level.

Though the mission was launched at the backdrop of achieving the unfinished agenda of MDGs, it was the need of the hour to provide for public health care system as a large proportion of the population from the poor and marginalized section of the society depend on the public health care system. In addition, it is realized that improving indicators on child mortality and safe motherhood is not only about the provisioning of health care centre but is about creating a trustful and empathetic environment to induce behavioral changes in terms of take-up of maternal health care services without any inhibitions. In India, economic, religious and societal factors govern women's decision with regard to the usage of health care services. As such, factors have to be taken into account while formulating and implementing the policy. Further, health cannot be looked in isolation as it requires inter-ministerial co-ordination and centre-state collective action to have more coherence in implementing the programme and avoid duplication in terms of allocation of funding and implementation efforts. The NRHM "Flexi-pool" funding provision is one of the innovative ways of bringing about having flexibility in funding and usage of the funds for the programme. Ministries such as the newly created, Ministry of Jal Shakti, that looks into the water and sanitation issues has to closely work with the Ministry of Health and Family Welfare to bring in more synergy among the governmental schemes, bringing more concordance in aims and objectives and to avoid implementation of programmes in straitjacketed manner. Health being state subject it is very important that the central government and state governments are committed to the national targets and initiate policies that complement and work in tandem with the national policies. Centre can take the lead and be the trailblazer to motivate state governments to increase their fund and manpower allocation to the health sector.

The external validity of this study is one of the strengths of this study. India is a diverse developing country in terms of language, economy, geography, culture, religious and socio-ethical background. In such a diverse population, this study tracked the evolution of a national level programme i.e. NRHM for over a decade. As such, we are confident that such an initiative will bring about better health indicators and more usage of maternal health care services in other developing countries.

6.3. Prospect for future research

With regard to the physical expansion of the health infrastructure, we looked only at the expansion of the lower level facility (Sub-centre). As discussed, the Sub-centre is equipped to provide preventive care with a lesser role in curative care. The curative part comes mainly at higher-level health facility like the community health centre (CHC), the sub-divisional hospital and the district hospital. The higher levels of health facility perform C-sections and handle other complicated cases. The availability of such higher-level health facility is vital for saving lives. Evaluating the impact of the availability of higher-level health facility seems to be an interesting area and has the potential for further research in this area as it could lead to a reduction in child mortality and maternal mortality. We also did not look into the area of maternal mortality in our study, though one of the objectives of NRHM is also to reduce the MMR. Finally, it is not only the availability of the health care centre but also the quality of health care plays a pivotal role in determining the usage of such services and hence reflects on the mortality indicators. This study limits itself to the availability only, more research is required in the areas of the quality of health care availability under the NRHM or broadly under the National Health Mission (NHM).

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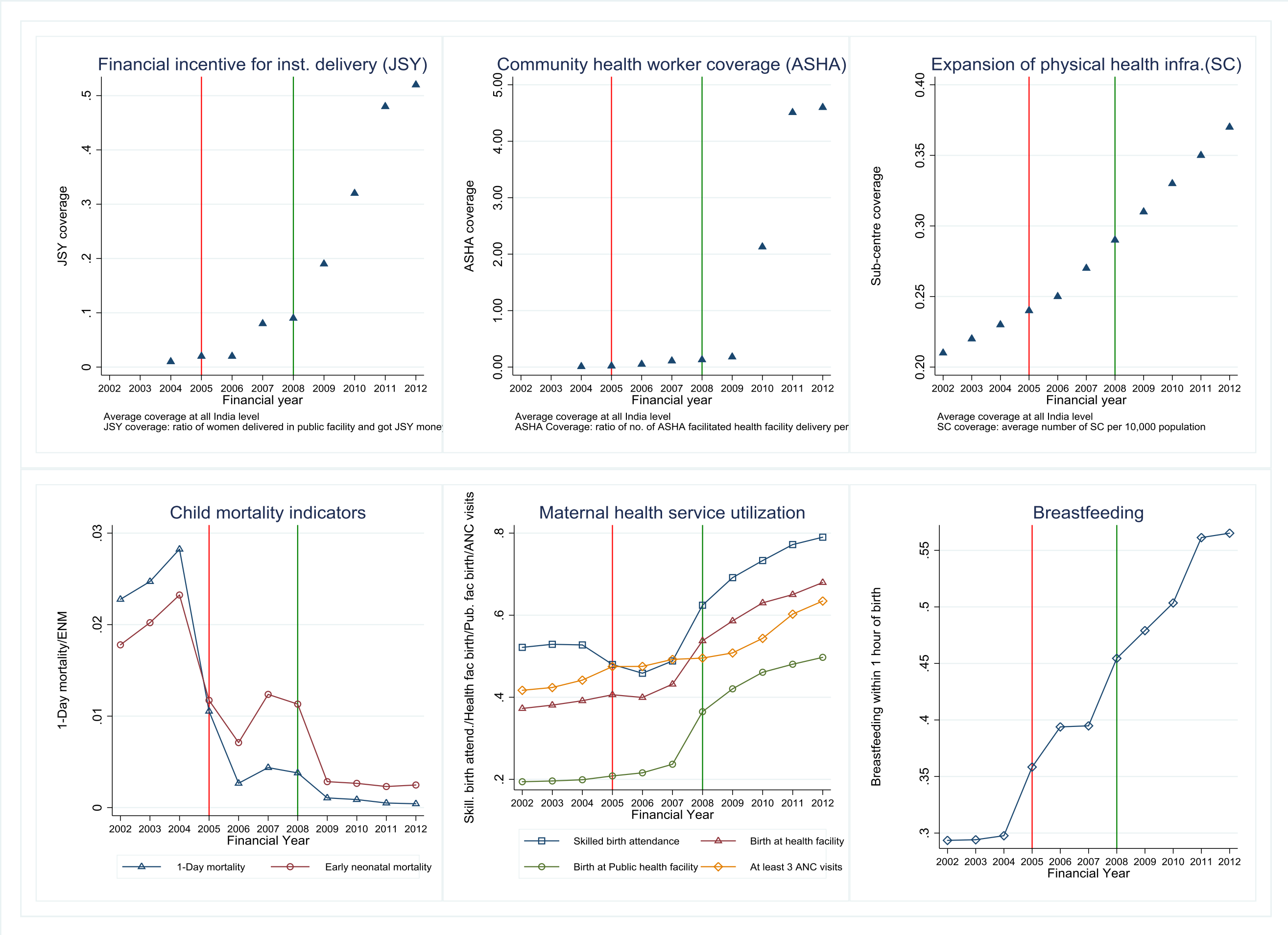
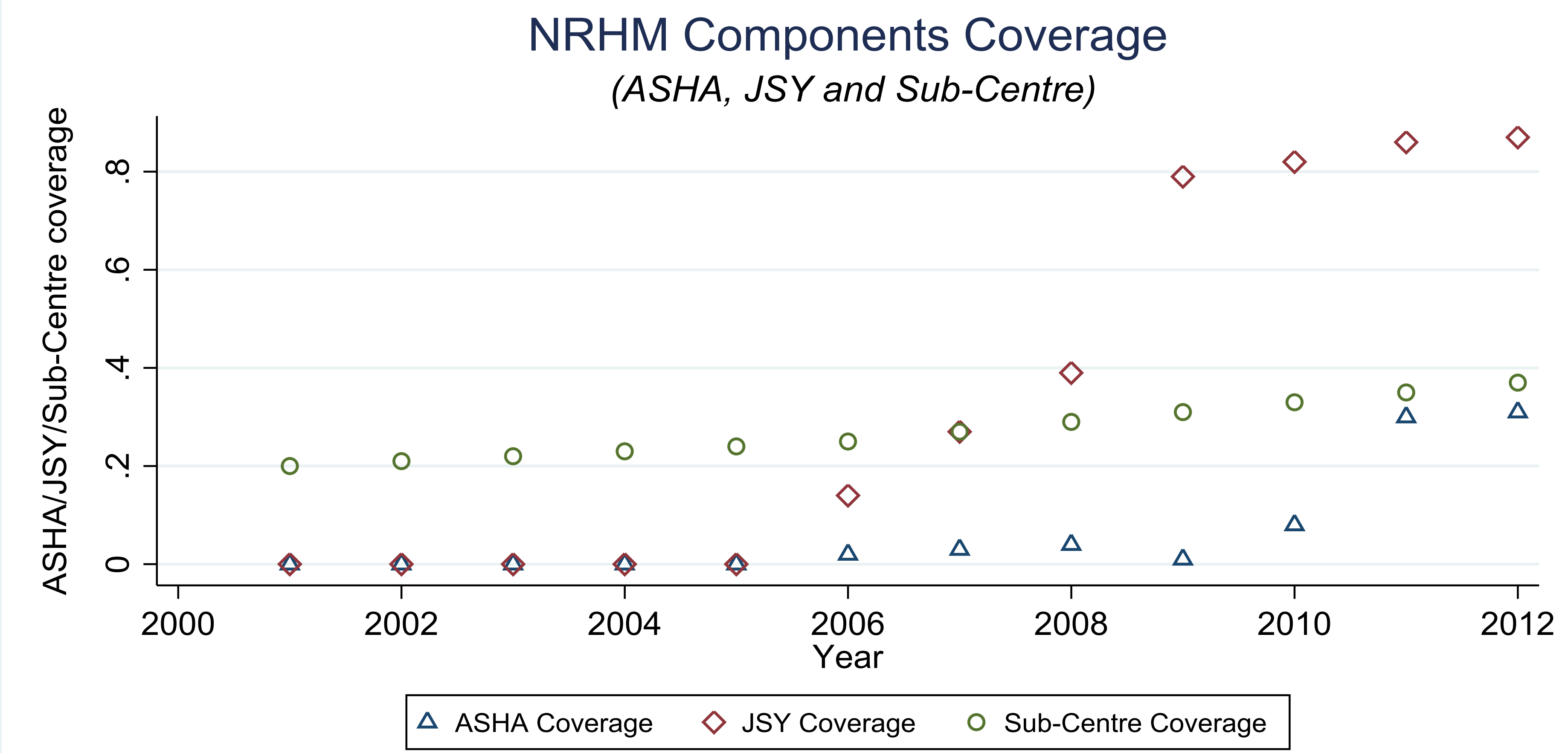
Figure 1.1
Expansion of the NRHM, child mortality, maternal health uptake, and breastfeeding



Note: Data is from DLHS-2, DLHS-3, DLHS-4 and AHS (2010-2012). The red line indicates the official launch of the NRHM programme (April 2005) whereas the green line indicates the actual expansion of various components of the programme is in 2008-09.

Figure 2.1



Average coverage at all India level
ASHA Coverage: ratio of no. of ASHA facilitated health facility delivery to all deliveries
JSY coverage: ratio of women delivered in public facility and got JSY money to all public facility delivery
SC coverage: average number of SC per 10,000 population
Source: Census, 2001, DLHS3 and DLHS4

Table 2.1

JSY coverage by year

JSY coverage	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12
JSY coverage 0-10%	279	163	98	35	32	26	20
JSY coverage 10-25%	150	137	143	65	55	58	56
JSY coverage 25-50%	123	163	162	120	127	132	125
JSY coverage >50%	38	124	184	321	331	331	344
Total number of districts	587	587	587	545	547	547	546

Notes: Data are from DLHS-3 and the DLHS-4. The JSY coverage refers to district level coverage measured by the ratio of the number of women who delivered in a public health facility and also received financial incentive under JSY to all the deliveries that took place in that public health facility of that district in that year. Here year refers to the financial year from 1st April to 31st March.

JSY coverage by year (high focus states)

JSY coverage	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12
JSY coverage 0-10%	165	81	42	19	11	10	7
JSY coverage 10-25%	89	76	46	16	13	16	18
JSY coverage 25-50%	72	96	90	23	27	27	22
JSY coverage >50%	30	103	178	293	300	299	305
Total number of districts	356	356	356	351	352	352	352

JSY coverage by year (low focus states)

JSY coverage	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12
JSY coverage 0-10%	114	82	56	20	21	16	13
JSY coverage 10-25%	61	61	97	49	42	42	38
JSY coverage 25-50%	51	67	72	97	100	105	103
JSY coverage >50%	5	21	6	28	31	32	39
Total number of districts	231	231	231	194	195	195	194

Table 2.2
Association of JSY coverage with mortality

	Infant mortality	Neonatal mortality	Early neonatal mortality	One day mortality
A. Baseline model				
	(1)	(2)	(3)	(4)
JSY coverage 10-25%	-0.0089*	-0.012**	0.0000071	-0.00073*
	(0.0045)	(0.0045)	(0.00072)	(0.00044)
JSY coverage 25-50%	-0.015**	-0.019***	-0.0011	-0.0018***
	(0.0063)	(0.0062)	(0.00086)	(0.00051)
JSY coverage >50%	-0.011*	-0.021***	-0.0073***	-0.0051***
	(0.0055)	(0.0055)	(0.00086)	(0.00059)
Observations	1856202	1831872	1842369	1842369
B. Baseline model with district and individual covariates				
JSY coverage 10-25%	-0.0100**	-0.012**	-0.00039	-0.00080*
	(0.0046)	(0.0045)	(0.00074)	(0.00045)
JSY coverage 25-50%	-0.015**	-0.019***	0.00045	-0.00036
	(0.0068)	(0.0068)	(0.00080)	(0.00050)
JSY coverage >50%	-0.012	-0.023***	-0.0021**	-0.0015**
	(0.0080)	(0.0081)	(0.00089)	(0.00061)
Observations	1827920	1804550	1817486	1817486
Mean of dep. variable at baseline	0.044	0.033	0.024	0.025
No. of districts	587	587	587	587

Notes: Data are from DLHS-2, DLHS-3, DLHS-4 and AHS (2010-12).
Standard errors, corrected for clustering at the district level, are reported in parentheses. Baseline model includes fixed effects for district and year of birth. The model with district and individual controls includes interaction terms of year of birth with the district level poor population, tribal population and wealth as well as individual controls for mother's education, mother's age at birth, recall period and dummies for categories of urban dwelling, religion, a multiple births, and survey round. The unit of observation is a delivery (most recent only). Deviations in sample size are due to missing data.
******* denotes significance at 1%, ** at 5% and * at 10% level.

Table 2.3
Association of JSY with services uptake and breastfeeding

	Health worker in attendance at delivery	Health Facility Birth	Public Health Facility Birth	Private Facility	At least 3 ANC visits	Breast Feeding within 1hr	Breast Feeding within 24hr
A. Baseline model							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
JSY coverage 10-25%	-0.0025	-0.0038	0.0041	-0.010**	-0.030***	0.019**	0.015**
	(0.0068)	(0.0062)	(0.0065)	(0.0045)	(0.0068)	(0.0088)	(0.0072)
JSY coverage 25-50%	0.0097	0.0044	0.015**	-0.014***	-0.029***	0.020**	0.032***
	(0.0078)	(0.0070)	(0.0073)	(0.0047)	(0.0086)	(0.010)	(0.0092)
JSY coverage >50%	0.096***	0.067***	0.091***	-0.039***	-0.0040	0.064***	0.11***
	(0.0091)	(0.0085)	(0.0088)	(0.0054)	(0.0094)	(0.013)	(0.013)
Observations	1847452	1846465	1859100	1859100	1755818	1837859	1837859
B. Baseline model with district and individual covariates							
JSY coverage 10-25%	0.00012	-0.0042	0.0034	-0.0095**	-0.025***	0.017**	0.0076
	(0.0062)	(0.0059)	(0.0065)	(0.0044)	(0.0061)	(0.0084)	(0.0074)
JSY coverage 25-50%	0.0026	-0.0037	-0.0013	-0.0047	-0.027***	0.0042	0.014
	(0.0065)	(0.0064)	(0.0070)	(0.0047)	(0.0080)	(0.0099)	(0.0091)
JSY coverage >50%	0.049***	0.032***	0.041***	-0.018***	-0.011	0.024*	0.054***
	(0.0078)	(0.0076)	(0.0081)	(0.0052)	(0.0098)	(0.013)	(0.012)
Observations	1819333	1818356	1830783	1830783	1729670	1811736	1811736
Mean of dep. variable at baseline	0.52	0.39	0.20	0.18	0.44	0.31	0.43
No. of districts	587	587	587	587	587	587	587

Notes: Data are from DLHS-2, DLHS-3, DLHS-4 and AHS (2010-12).
Standard errors, corrected for clustering at the district level, are reported in parentheses. A health worker is in attendance if the birth is in a health facility or at home with a doctor, nurse, midwife, or lady health volunteer. Baseline model includes fixed effects for district and year of birth. The model with district and individual controls includes interaction terms of year of birth with the district level poor population, tribal population and wealth as well as individual controls for mother's education, mother's age at birth, recall period and dummies for categories of urban dwelling, religion, a multiple births, and survey round. The unit of observation is a delivery (most recent only). Deviations in sample size are due to missing data.
******* denotes significance at 1%, ** at 5% and * at 10% level.

Table 2.4
1st Falsification Test for JSY coverage

	Infant mortality	Neonatal mortality	One day mortality	Health Facility Birth	Public Health Facility Birth
A. Baseline model					
Time	-0.0037***	-0.0027***	-0.0034***	0.015***	0.0064**
	(0.00093)	(0.00082)	(0.00076)	(0.0031)	(0.0026)
Time × JSY coverage	0.00064	0.0018	0.00079	-0.018***	-0.0038
	(0.0018)	(0.0016)	(0.0014)	(0.0057)	(0.0048)
Observations	156780	156766	156780	159948	160106
B. Baseline model with district and individual controls					
Time	0.00025	0.0011	0.0012	0.0073	0.0026
	(0.0015)	(0.0013)	(0.0011)	(0.0047)	(0.0047)
Time × JSY coverage	0.0014	0.0024	0.0013	-0.0064	0.00038
	(0.0019)	(0.0016)	(0.0013)	(0.0058)	(0.0056)
Observations	156687	156673	156687	156702	156845

Notes: Data are from the DLHS-2, the DLHS-3, and the DLHS-4. While coverage is average coverage in the post-period (2006-2011) the outcomes are for the pre-JSY period (i.e. pre-April, 2005).
Standard errors, corrected for clustering at the district level, are reported in parentheses.
Baseline model includes time (a birth year since the start of data period), an interaction between time and coverage of JSY and fixed effects for districts. Model with district and individual controls includes interactions between year of birth and district share of the population below the poverty line, tribal population share, and wealth asset score as well as individual controls for mother's education, mother's age at birth, wealth asset score, recall period, and dummies for categories of urban dwelling, religion, a multiple birth, and survey round.
***denotes significance at 1%, ** at 5% and * at 10% level.

Table 2.5
2nd Falsification Test for JSY Coverage

	Infant mortality	Neonatal mortality	One day mortality	Health Facility Birth	Public Health Facility Birth
A. Baseline model					
Time	-0.0023**	-0.0015*	-0.0023***	0.021***	0.012***
	(0.0011)	(0.00094)	(0.00089)	(0.0039)	(0.0034)
Time × JSY Coverage	-0.0013	-0.000032	-0.00065	-0.017***	-0.0085**
	(0.0015)	(0.0013)	(0.0013)	(0.0050)	(0.0041)
Observations	156454	156440	156454	156469	156611
B. Baseline model including individual and district level covariates					
Time	0.0041**	0.0037**	0.0040***	0.013**	0.0084
	(0.0017)	(0.0015)	(0.0013)	(0.0057)	(0.0057)
Time × JSY Coverage	-0.0016	-0.00020	-0.00052	-0.0064	-0.0064
	(0.0015)	(0.0013)	(0.0011)	(0.0054)	(0.0052)
Observations	156362	156348	156362	156378	156519

Notes: Data are from the DLHS-2, the DLHS-3, and the DLHS-4. While the JSY coverage data pertains to the year 2012, the outcomes are for the pre-JSY period (i.e. pre-April, 2005).

Standard errors, corrected for clustering at the district level, are reported in parentheses.

Baseline model includes time (a birth year since the start of data period), an interaction between time and coverage of JSY and fixed effects for districts. Model with district and individual controls includes interactions between year of birth and district share of the population below the poverty line, tribal population share, and wealth asset score as well as individual controls for mother's education, mother's age at birth, wealth asset score, recall period, and dummies for categories of urban dwelling, religion, a multiple birth, and survey round. Deviation in sample size is due to missing data.

***denotes significance at 1%, ** at 5% and * at 10% level.

Table 3.1

ASHA coverage by year

ASHA coverage	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12
ASHA coverage =0	312	244	211	361	78	58	57
ASHA coverage >0 & < 5%	214	263	255	72	154	76	67
ASHA coverage 5-20%	54	60	98	100	283	178	184
ASHA coverage >20%	7	20	23	12	32	235	238
Total number of districts	587	587	587	545	547	547	546

Notes: Data are from DLHS-3 and the DLHS-4. The ASHA coverage refers to district level coverage measured by the ratio of the number of women who were motivated by ASHA to for Ante Natal Check-up or motivated for health facility delivery to all the deliveries that took place in that district that year. Here year refers to the financial year from 1st April to 31st March.

ASHA coverage by year (high focus states)

ASHA coverage	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12
ASHA coverage =0	128	84	51	309	26	20	18
ASHA coverage >0 & < 5%	173	199	190	16	95	21	22
ASHA coverage 5-20%	48	53	92	19	207	87	89
ASHA coverage >20%	7	20	23	7	24	224	223
Total number of districts	356	356	356	351	352	352	352

ASHA coverage by year (low focus states)

ASHA coverage	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12
ASHA coverage =0	184	160	160	52	52	38	39
ASHA coverage >0 & < 5%	41	64	65	56	59	55	45
ASHA coverage 5-20%	6	7	6	81	76	91	95
ASHA coverage >20%	0	0	0	5	8	11	15
Total number of districts	231	231	231	194	195	195	194

Table 3.2
Association of ASHA coverage with mortality

	Infant mortality	Neonatal mortality	One day mortality
A. Baseline model			
	(1)	(2)	(3)
ASHA coverage <5%	-0.0085*	-0.0050	0.0023***
	(0.0049)	(0.0050)	(0.00032)
ASHA coverage 5-20%	-0.0099*	-0.0082	0.0016***
	(0.0054)	(0.0054)	(0.00033)
ASHA coverage >20%	-0.014**	-0.013**	0.00056
	(0.0062)	(0.0063)	(0.00040)
Observations	1857029	1832699	1843196
B. Baseline model with individual and district covariates			
ASHA coverage <5%	-0.0084**	-0.0061	-0.0014***
	(0.0039)	(0.0039)	(0.00036)
ASHA coverage 5-20%	-0.0077*	-0.0077*	-0.0012***
	(0.0046)	(0.0046)	(0.00036)
ASHA coverage >20%	-0.010**	-0.011**	-0.0018***
	(0.0052)	(0.0052)	(0.00040)
Observations	1828743	1805373	1818309
No. of districts	587	587	587

Notes: Data are from DLHS-2, DLHS-3, DLHS-4 and AHS (2010-12).
Standard errors, corrected for clustering at the district level, are reported in parentheses. Baseline model includes fixed effects for district and year of birth. The model with district and individual controls includes interaction terms of year of birth with the district level poor population, tribal population and wealth as well as individual controls for mother's education, mother's age at birth, recall period and dummies for categories of urban dwelling, religion, a multiple births, and survey round. The unit of observation is a delivery (most recent only). Deviations in sample size are due to missing data.
******* denotes significance at 1%, ** at 5% and * at 10% level.

Table 3.3
Association of ASHA with services uptake and breastfeeding

	Health worker in attendance at delivery	Health Facility Birth	Public Health Facility Birth	Private Facility	At least 3 ANC visits	Breast Feeding within 1hr	Breast Feeding within 24hr
A. Baseline model							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
ASHA coverage <5%	-0.074***	-0.048***	-0.048***	0.0096***	-0.029***	-0.021***	-0.0044
	(0.0052)	(0.0047)	(0.0046)	(0.0027)	(0.0057)	(0.0065)	(0.0060)
ASHA coverage 5-20%	-0.035***	-0.019***	-0.018***	0.0030	0.0026	0.0073	0.010
	(0.0065)	(0.0055)	(0.0054)	(0.0029)	(0.0060)	(0.0073)	(0.0065)
ASHA coverage >20%	0.0034	0.024***	0.034***	-0.0067*	0.029***	0.053***	0.014
	(0.0089)	(0.0073)	(0.0071)	(0.0040)	(0.0086)	(0.0098)	(0.0091)
Observations	1848288	1847296	1859936	1859936	1756520	1838690	1838690
B. Baseline model with individual and district level covariates							
ASHA coverage <5%	-0.042***	-0.019***	-0.0073	-0.0076**	-0.011**	0.0077	0.014**
	(0.0048)	(0.0045)	(0.0047)	(0.0030)	(0.0053)	(0.0065)	(0.0065)
ASHA coverage 5-20%	-0.013**	0.0033	0.018***	-0.015***	0.014**	0.024***	0.027***
	(0.0059)	(0.0053)	(0.0055)	(0.0033)	(0.0059)	(0.0074)	(0.0077)
ASHA coverage >20%	0.015*	0.047***	0.070***	-0.023***	0.041***	0.058***	0.023**
	(0.0078)	(0.0071)	(0.0073)	(0.0045)	(0.0084)	(0.010)	(0.011)
Observations	1820165	1819183	1831615	1831615	1730368	1812563	1812563
No. of districts	587	587	587	587	587	587	587

Notes: Data are from DLHS-2, DLHS-3, DLHS-4 and AHS (2010-12).
Standard errors, corrected for clustering at the district level, are reported in parentheses. A health worker is in attendance if the birth is in a health facility or at home with a doctor, nurse, midwife, or lady health volunteer. Baseline model includes fixed effects for district and year of birth. The model with district and individual controls includes interaction terms of year of birth with the district level poor population, tribal population and wealth as well as individual controls for mother's education, mother's age at birth, recall period and dummies for categories of urban dwelling, religion, a multiple births, and survey round. The unit of observation is a delivery (most recent only). Deviations in sample size are due to missing data.
******* denotes significance at 1%, ** at 5% and * at 10% level.

Table 3.4
1st Falsification Test for ASHA Coverage

	Infant mortality	Neonatal mortality	One day mortality	Health Facility Birth	Public Health Facility Birth
A. Baseline model					
Time	-0.0033***	-0.0020***	-0.0031***	0.010***	0.0069***
	(0.00060)	(0.00051)	(0.00047)	(0.0019)	(0.0018)
Time × ASHA Coverage	-0.00086	0.0026	0.00100	-0.050**	-0.028*
	(0.0057)	(0.0044)	(0.0040)	(0.019)	(0.017)
Observations	156780	156766	156780	159948	160106
B. Baseline model with district and individual controls					
Time	0.00076	0.0018	0.0014	0.0062	0.0048
	(0.0013)	(0.0011)	(0.00094)	(0.0038)	(0.0038)
Time × ASHA Coverage	0.0031	0.0068	0.0052	-0.027	-0.024
	(0.0058)	(0.0044)	(0.0038)	(0.018)	(0.016)
Observations	156687	156673	156687	156702	156845

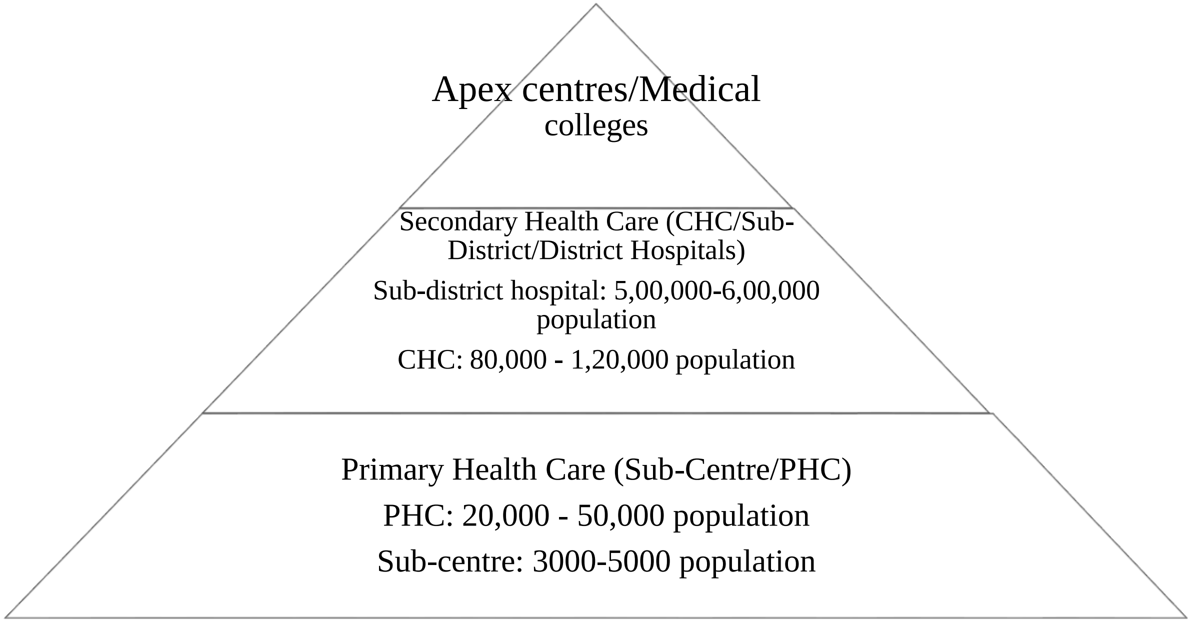
Notes: Data are from the DLHS-2, the DLHS-3, and the DLHS-4. While coverage is average coverage in the post-period (2005-2012) the outcomes are for the pre-ASHA period (i.e. pre-April, 2005).
Standard errors, corrected for clustering at the district level, are reported in parentheses.
Baseline model includes time (a birth year since the start of data period), an interaction between time and coverage of JSY and fixed effects for districts. Model with district and individual controls includes interactions between year of birth and district share of the population below the poverty line, tribal population share, and wealth asset score as well as individual controls for mother's education, mother's age at birth, wealth asset score, recall period, and dummies for categories of urban dwelling, religion, a multiple birth, and survey round.
***denotes significance at 1%, ** at 5% and * at 10% level.

Table 3.5
2nd Falsification Test for ASHA Coverage

	Infant mortality	Neonatal mortality	One day mortality	Health Facility Birth	Public Health Facility Birth
A. Baseline model					
Time	-0.0033***	-0.0018***	-0.0030***	0.011***	0.0082***
	(0.00065)	(0.00057)	(0.00053)	(0.0023)	(0.0020)
Time × ASHA Coverage	0.00035	0.0012	0.00079	-0.013*	-0.011*
	(0.0022)	(0.0020)	(0.0019)	(0.0071)	(0.0063)
Observations	156454	156440	156454	156469	156611
B. Baseline model with individual and district level covariates					
Time	0.0024*	0.0030**	0.0030***	0.0098**	0.0058
	(0.0014)	(0.0012)	(0.0010)	(0.0039)	(0.0041)
Time × ASHA Coverage	0.0015	0.0023	0.0022	-0.0072	-0.0098
	(0.0021)	(0.0018)	(0.0016)	(0.0066)	(0.0065)
Observations	156362	156348	156362	156378	156519

Notes: Data are from the DLHS-2, the DLHS-3, and the DLHS-4. While the ASHA coverage data pertains to the year 2012, the outcomes are for the pre-ASHA period (i.e. pre-April, 2005).
Standard errors, corrected for clustering at the district level, are reported in parentheses.
Baseline model includes time (a birth year since the start of data period), an interaction between time and coverage of ASHA and fixed effects for districts. Model with district and individual controls includes interactions between year of birth and district share of the population below the poverty line, tribal population share, and wealth asset score as well as individual controls for mother's education, mother's age at birth, wealth asset score, recall period, and dummies for categories of urban dwelling, religion, a multiple birth, and survey round.
***denotes significance at 1%, ** at 5% and * at 10% level.

Figure 4.1
Hierarchy of the public health care system in India



Notes: Indian health care system can broadly be divided into three levels i.e. primary, secondary and tertiary. Sub-Centre (SC) and Primary Health Centre (PHC) constitute the primary health care. A sub-centre caters to 3000 population in hilly/tribal/desert areas and 5000 population in plain areas. It is the first point of contact for the community for any health-related needs. It generally provides preventive and promotive services and sometimes basic curative services also. PHC is the first point of contact for a qualified doctor. One PHC covers 20, 000 population in hilly/tribal/desert areas and 30, 000 population in plain areas with six indoor/observation beds. It is a referral unit for 6 sub-centres and refers out cases to Community Health Centres (CHC) or higher-level public hospital at sub-district or district level. A CHC is a 30-bedded hospital providing specialist care in Medicine, Obstetrics and Gynecology, Surgery, Pediatrics, Dental and AYUSH (Ayurveda, Yoga and Naturopathy, Unani, Siddha, and Homoeopathy). The CHCs acts as a referral unit for the PHCs and can be approached directly for any specialist care. One CHC is referred cases by four PHCs, thereby it caters to approximately 80,000 populations in tribal/hilly/desert areas and 1,20,000 population for plain areas. The Sub-District/Sub-Divisional hospital caters to 5,00,000-6,00,000 population and is the first referral unit for Tehsil/Taluk/Block population in which they are located. They have 31 to 100 or more beds. Every district is expected to have a district hospital. But, the population of a district is variable therefore bed strength also varies from 75 to 500 beds depending on factors like the size, terrain, and population of the district (Source: Indian Public Health Standards, Ministry of Health and Family Welfare, Government of India, 2012).

Table 4.1

Sub-centre coverage by year

Sub-centre coverage (per 10,000 population)	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
SC Coverage >=0 & <0.5	124	108	90	79	56	43	26	15	10	8	7	5
SC Coverage >=0.5 & <1	208	211	217	222	226	218	205	180	156	116	85	67
SC Coverage >=1 & <1.5	132	135	138	134	142	147	160	183	192	202	203	198
SC Coverage >=1.5	78	88	97	107	118	134	151	164	184	216	247	272
Total number of districts	542	542	542	542	542	542	542	542	542	542	542	542

Notes: Data is from the DLHS-4. The Sub-Centre coverage refers to the ratio of number of Sub-centre available in a district at time "t" to the population of the sampled PSU. This ratio is multiplied by 10,000 to get per 10,000 population availability of Sub-centre. The PSU is a village in the district. Here year refers to a calendar year from 1st January to 31st December.

Sub-centre coverage by year (high focus states)

Sub-centre coverage (per 10,000 population)	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
SC Coverage >=0 & <0.5	88	80	68	58	41	33	18	9	4	2	1	0
SC Coverage >=0.5 & <1	140	139	144	153	154	145	145	132	117	85	66	49
SC Coverage >=1 & <1.5	66	69	68	67	76	82	84	97	104	116	122	128
SC Coverage >=1.5	58	64	72	74	81	92	105	114	127	149	163	175
Total number of districts	352	352	352	352	352	352	352	352	352	352	352	352

Sub-centre coverage by year (low focus states)

Sub-centre coverage (per 10,000 population)	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
SC Coverage >=0 & <0.5	36	28	22	21	15	10	8	6	6	6	6	5
SC Coverage >=0.5 & <1	68	72	73	69	72	73	60	48	39	31	19	18
SC Coverage >=1 & <1.5	66	66	70	67	66	65	76	86	88	86	81	70
SC Coverage >=1.5	20	24	25	33	37	42	46	50	57	67	84	97
Total number of districts	190	190	190	190	190	190	190	190	190	190	190	190

Table 4.2
Association of Sub-centre coverage with mortality

	Infant mortality	Neonatal mortality	Early neonatal mortality	One day mortality
A. Baseline model				
SC coverage 0.5-1	-0.022***	-0.028***	-0.0024***	-0.0029***
	(0.0072)	(0.0073)	(0.00082)	(0.00087)
SC coverage 1-1.5	-0.036***	-0.042***	-0.0035***	-0.0040***
	(0.011)	(0.011)	(0.00090)	(0.00088)
SC coverage >1.5	-0.026*	-0.031**	-0.0030***	-0.0036***
	(0.015)	(0.016)	(0.0011)	(0.00099)
Observations	1830656	1806326	1816823	1816823
B. Baseline model with district and individual covariates				
SC coverage 0.5-1	-0.021***	-0.027***	-0.0012	-0.0018**
	(0.0077)	(0.0078)	(0.00084)	(0.00086)
SC coverage 1-1.5	-0.033***	-0.038***	-0.0024**	-0.0027***
	(0.011)	(0.011)	(0.00093)	(0.00087)
SC coverage >1.5	-0.021	-0.028*	-0.0023**	-0.0028***
	(0.015)	(0.015)	(0.0011)	(0.00097)
Observations	1802383	1779013	1791949	1791949
Mean of dep. variable at baseline	0.044	0.033	0.024	0.025
No. of districts	529	529	529	529

Notes: Data are from DLHS-2, DLHS-3, DLHS-4 and AHS (2010-12).
Standard errors, corrected for clustering at the district level, are reported in parentheses. Baseline model includes fixed effects for district and year of birth. The model with district and individual controls includes interaction terms of year of birth with the district level poor population, tribal population and wealth as well as individual controls for mother's education, mother's age at birth, recall period and dummies for categories of urban dwelling, religion, a multiple births, and survey round. The number of districts here is 529 as data for around 58 districts were not collected in the facility survey of DLHS-4. Coverage data is from DLHS-4. The unit of observation is a delivery (most recent only). Deviations in sample size are due to missing data.
******* denotes significance at 1%, ** at 5% and * at 10% level.

Table 4.3
Association of Sub-centre with services uptake and breastfeeding

	Health worker in attendance at delivery	Health Facility Birth	Public Health Facility Birth	Private Facility	At least 3 ANC visits	Breast Feeding within 1hr	Breast Feeding within 24hr
A. Baseline model							
SC coverage 0.5-1	0.042***	0.0048	-0.0035	0.00077	-0.012	0.024*	0.12***
	(0.011)	(0.010)	(0.011)	(0.0053)	(0.010)	(0.014)	(0.015)
SC coverage 1-1.5	0.065***	0.030**	0.019	0.0012	0.0056	0.052***	0.11***
	(0.013)	(0.012)	(0.013)	(0.0069)	(0.014)	(0.016)	(0.018)
SC coverage >1.5	0.059***	0.034**	0.025	-0.0017	0.020	0.051***	0.066***
	(0.016)	(0.015)	(0.015)	(0.0091)	(0.017)	(0.019)	(0.022)
Observations	1821857	1820948	1833489	1833489	1730384	1812588	1812588
B. Baseline model including individual and district level covariates							
SC coverage 0.5-1	0.011	-0.020*	-0.027**	0.0031	-0.0086	0.0032	0.080***
	(0.010)	(0.011)	(0.012)	(0.0048)	(0.010)	(0.014)	(0.014)
SC coverage 1-1.5	0.035***	0.0031	-0.0039	0.0016	0.010	0.025	0.076***
	(0.011)	(0.012)	(0.013)	(0.0063)	(0.014)	(0.017)	(0.016)
SC coverage >1.5	0.041***	0.014	0.0062	-0.0018	0.021	0.035*	0.051***
	(0.013)	(0.014)	(0.015)	(0.0080)	(0.017)	(0.019)	(0.019)
Observations	1793747	1792848	1805181	1805181	1704237	1786474	1786474
Mean of dep. variable at baseline	0.52	0.39	0.20	0.18	0.44	0.31	0.43
No. of districts	529	529	529	529	529	529	529

Notes: Data are from DLHS-2, DLHS-3, DLHS-4 and AHS (2010-12).

Standard errors, corrected for clustering at the district level, are reported in parentheses. A health worker is in attendance if the birth is in a health facility or at home with a doctor, nurse, midwife, or lady health volunteer. Baseline model includes fixed effects for district and year of birth. The model with district and individual controls includes interaction terms of year of birth with the district level poor population, tribal population and wealth as well as individual controls for mother's education, mother's age at birth, recall period and dummies for categories of urban dwelling, religion, a multiple births, and survey round. The number of districts here is 529 as data for around 58 districts were not collected in the facility survey of DLHS-4. Coverage data is from DLHS-4. The unit of observation is a delivery (most recent only). Deviations in sample size are due to missing data.

******* denotes significance at 1%, ** at 5% and * at 10% level.

Table 4.4
1st Falsification test for sub-centre coverage

	Infant mortality	Neonatal mortality	One day mortality	Health Facility Birth	Health worker in attendance at delivery
A. Baseline model					
Time	-0.0036***	-0.0017***	-0.0034***	0.0071***	-0.016***
	(0.00068)	(0.00059)	(0.00054)	(0.0019)	(0.0022)
Time × SC Coverage	0.00028	0.00013	0.00039*	0.00093	0.0016
	(0.00027)	(0.00022)	(0.00020)	(0.0011)	(0.0011)
Observations	155933	155919	155933	155946	155926
B. Baseline model with district and individual covariates					
Time	0.0031**	0.0039***	0.0037***	0.0069*	0.0068
	(0.0013)	(0.0011)	(0.00098)	(0.0037)	(0.0043)
Time × SC Coverage	-0.00026	-0.00029	-0.00012	0.00097	0.0012
	(0.00031)	(0.00027)	(0.00024)	(0.0011)	(0.0012)
Observations	155841	155827	155841	155855	155833
No. of districts	529	529	529	529	529

Notes: Data are from the DLHS-2, the DLHS-3, and the DLHS-4. While coverage is average coverage in the post-period (2006-2011) the outcomes are for the pre-April, 2005).

Standard errors, corrected for clustering at the district level, are reported in parentheses. A health worker is in attendance if the birth is in a health facility or at home with a doctor, nurse, midwife, or lady health volunteer.

Baseline model includes time (a birth year since the start of data period), an interaction between time and coverage of Sub-Centre and fixed effects for districts. Model with district and individual controls includes interactions between year of birth and district share of the population below the poverty line, tribal population share, and wealth asset score as well as individual controls for mother's education, mother's age at birth, wealth asset score, recall period, and dummies for categories of urban dwelling, religion, a multiple birth, and survey round. Deviations in sample size are due to missing data.

***denotes significance at 1%, ** at 5% and * at 10% level.

Table 4.5
2nd Falsification test for sub-centre coverage

	Infant mortality	Neonatal mortality	One day mortality	Health Facility Birth	Health worker in attendance at delivery
A. Baseline model					
Time	-0.0036***	-0.0018***	-0.0034***	0.0073***	-0.016***
	(0.00068)	(0.00059)	(0.00054)	(0.0021)	(0.0022)
Time × SC Coverage	0.00023	0.00015	0.00036**	0.00063	0.0013
	(0.00023)	(0.00019)	(0.00017)	(0.00100)	(0.00097)
Observations	155933	155919	155933	155946	155926
B. Baseline model with district and individual covariates					
Time	0.0031**	0.0039***	0.0038***	0.0071*	0.0069
	(0.0013)	(0.0011)	(0.00098)	(0.0037)	(0.0044)
Time × SC Coverage	-0.00028	-0.00025	-0.00012	0.00074	0.0010
	(0.00027)	(0.00024)	(0.00021)	(0.0011)	(0.0011)
Observations	155841	155827	155841	155855	155833
No. of districts	529	529	529	529	529

Notes: Data are from the DLHS-2, the DLHS-3, and the DLHS-4. While the ASHA coverage data pertains to the calendar year 2011, the outcomes are for the pre-ASHA period (i.e. pre-April, 2005).
Standard errors, corrected for clustering at the district level, are reported in parentheses.
Baseline model includes time (a birth year since the start of data period), an interaction between time and coverage of Sub-Centre and fixed effects for districts. Model with district and individual controls includes interactions between year of birth and district share of the population below the poverty line, tribal population share, and wealth asset score as well as individual controls for mother's education, mother's age at birth, wealth asset score, recall period, and dummies for categories of urban dwelling, religion, a multiple birth, and survey round. Deviations in sample size are due to missing data.
***denotes significance at 1%, ** at 5% and * at 10% level.

Table 5.1
Association of all components of NRHM with mortality

	Infant mortality	Neonatal mortality	Early neonatal mortality	One day mortality
JSY coverage >10%	-0.012**	-0.016***	-0.00020	-0.00053
	(0.0056)	(0.0056)	(0.00072)	(0.00043)
ASHA coverage >0	-0.0084**	-0.0070*	0.0017***	-0.0015***
	(0.0039)	(0.0038)	(0.00049)	(0.00036)
SC coverage >0.5	-0.021***	-0.027***	-0.0012	-0.0017*
	(0.0077)	(0.0078)	(0.00084)	(0.00086)
Observations	1801576	1778206	1791142	1791142
No. of districts	529	529	529	529

Notes: Data are from DLHS-2, DLHS-3, DLHS-4 and AHS (2010-12).
Standard errors, corrected for clustering at the district level, are reported in parentheses. This model includes fixed effects for district and year of birth. In addition, it also includes district and individual controls that comprises of interaction terms of year of birth with the district level poor population, tribal population and wealth as well as individual controls for mother's education, mother's age at birth, recall period and dummies for categories of urban dwelling, religion, a multiple birth, and survey round. The number of districts here is 529 as data for around 58 districts were not collected in the facility survey of DLHS-4. The unit of observation is a delivery (most recent only). Deviations in sample size are due to missing data. Deviations in sample size are due to missing data.
******* denotes significance at 1%, ** at 5% and * at 10% level.

Table 5.2
Association of all components of NRHM with service uptake and breastfeeding

	Health worker in attendance at delivery	Health Facility Birth	Public Health Facility Birth	Private Facility	At least 3 ANC visits	Breast Feeding within 1hr	Breast Feeding within 24hr
JSY coverage >10%	0.0048	-0.0035	0.0032	-0.0100**	-0.027***	0.0099	0.0096
	(0.0059)	(0.0055)	(0.0061)	(0.0042)	(0.0067)	(0.0089)	(0.0077)
ASHA coverage >0	-0.027***	-0.0043	0.0093*	-0.011***	0.0036	0.019***	0.022***
	(0.0052)	(0.0047)	(0.0050)	(0.0029)	(0.0053)	(0.0067)	(0.0068)
SC coverage >0.5	0.0082	-0.022*	-0.029**	0.0040	-0.010	0.00032	0.081***
	(0.011)	(0.011)	(0.012)	(0.0047)	(0.0099)	(0.014)	(0.014)
Observations	1792931	1792037	1804365	1804365	1703553	1785663	1785663
No. of districts	529	529	529	529	529	529	529

Notes: Data are from DLHS-2, DLHS-3, DLHS-4 and AHS (2010-12).
Standard errors, corrected for clustering at the district level, are reported in parentheses. A health worker is in attendance if the birth is in a health facility or at home with a doctor, nurse, midwife, or lady health volunteer. This model includes fixed effects for district and year of birth. In addition, it also includes district and individual controls that comprises of interaction terms of year of birth with the district level poor population, tribal population and wealth as well as individual controls for mother's education, mother's age at birth, recall period and dummies for categories of urban dwelling, religion, a multiple birth, and survey round. The number of districts here is 529 as data for around 58 districts were not collected in the facility survey of DLHS-4. The unit of observation is a delivery (most recent only). Deviations in sample size are due to missing data.
******* denotes significance at 1%, ** at 5% and * at 10% level.

Table 5.3
Interactions of all the components of NRHM and mortality

	Infant mortality	Neonatal mortality	Early neonatal mortality	One day mortality
A. Main effects				
JSY coverage >10%	-0.030***	-0.038***	-0.0021***	-0.0012***
	(0.010)	(0.011)	(0.00073)	(0.00044)
ASHA coverage >0	0.0084	0.0021	-0.0029	-0.0017**
	(0.014)	(0.012)	(0.0037)	(0.00070)
SC coverage >0.5	-0.043***	-0.044***	-0.0024***	-0.0017***
	(0.012)	(0.012)	(0.00078)	(0.00042)
B. Interaction terms				
JSY coverage>10% × SC coverage>0.5=1	0.039***	0.041***	0.0016**	0.00100**
	(0.012)	(0.012)	(0.00077)	(0.00043)
ASHA coverage >0 × SC coverage>0.5=1	-0.0023	0.0030	0.0063	0.0014
	(0.016)	(0.014)	(0.0041)	(0.00100)
JSY coverage>10% × ASHA coverage>0	-0.011	-0.0052	0.0019	0.00077
	(0.014)	(0.012)	(0.0037)	(0.00073)
JSY coverage>10% × ASHA coverage>0 × SC coverage>0.5	0.0050	-0.00038	-0.0060	-0.00085
	(0.016)	(0.014)	(0.0041)	(0.0010)
F test	3.09	3.16	2.52	2.57
P-value (Prob>F)	0.0155	0.0138	0.0403	0.0372
Observations	1675345	1651989	1664911	1664911
No. of districts	529	529	529	529

Notes: Data are from DLHS-2, DLHS-3, DLHS-4 and AHS (2010-12).

Standard errors, corrected for clustering at the district level, are reported in parentheses. This model includes fixed effects for district and year of birth. In addition, it also includes district and individual controls that comprises of interaction terms of year of birth with the district level poor population, tribal population and wealth as well as individual controls for mother's education, mother's age at birth, recall period and dummies for categories of urban dwelling, religion, a multiple birth, and survey round. The number of districts here is 529 as data for around 58 districts were not collected in the facility survey of DLHS-4. JSY dummy is 1 if JSY coverage is greater than 10%. ASHA dummy takes the value 1 if ASHA coverage is more than zero and Sub-Centre dummy takes the value 1 if SC coverage is more than 0.5. The unit of observation is a delivery (most recent only). Deviations in sample size are due to missing data. F test checks if all the interaction terms are equal to zero or not.

******* denotes significance at 1%, ** at 5% and * at 10% level

Appendix Tables

Table A 1.1
Mortality rates among neighboring counties and country groups

	India	Bangladesh	Nepal	South Asia	Sub-Saharan Africa	Low & middle income
Infant Mortality rate (per 1,000 live births)						
1990	88.5	99.7	97.5	91.7	107.8	70.8
2000	66.7	64.0	60.2	68.9	93.0	58.8
2011	43.2	36.9	35.8	46.8	62.8	39.1
2017	32.0	26.9	27.8	36.4	51.5	32.0

	India	Bangladesh	Nepal	South Asia	Sub-Saharan Africa	Low & middle income
Neonatal Mortality rate (per 1,000 live births)						
1990	57.4	64.1	58.5	58.6	45.7	40.0
2000	45.1	42.4	40.6	46.6	40.7	33.6
2011	30.8	25.9	26.5	33.3	31.3	23.3
2017	24.0	18.4	20.7	26.9	27.2	19.6

	India	Bangladesh	Nepal	South Asia	Sub-Saharan Africa	Low & middle income
Maternal mortality ratio per 100, 000 live births (modeled estimate)						
1990	556	569	901	558	987	428
2000	374	399	548	388	846	378
2011	206	228	328	218	601	262
2015	174	176	258	182	547	238

Notes: Data is from the World Bank, World Development Indicators, World Bank Databank.

The world bank defines maternal mortality ratio is the number of women who die from pregnancy-related causes while pregnant or within 42 days of pregnancy termination per 100,000 live births. The data are estimated with a regression model using the information on the proportion of maternal deaths among non-AIDS deaths in women ages 15-49, fertility, birth attendants, and GDP measured using purchasing power parities (PPPs). The neonatal mortality rate is the number of neonates dying before reaching 28 days of age, per 1,000 live births in a given year. The infant mortality rate is the number of infants dying before reaching one year of age, per 1,000 live births in a given year.

Table A 1.2
India - Infant mortality indicators 1980 - 2013

	Infant mortality rate			Neonatal mortality rate		
	Rural	Urban	Total	Rural	Urban	Total
1980	124	65	114	76	39	69
1990	86	50	80	57	31	53
2000	74	44	68	49	27	44
2005	64	40	58	41	23	37
2011	48	29	44	34	17	31
2012	46	28	42	33	16	29
2013	44	27	40	31	15	28

Note: Data is from SRS (Registrar General of India, Ministry of Home Affairs), the data excludes Nagaland (Rural) due to part-receipt of returns from 1995 to 2003.

Table A 1.3

Current Health Expenditure (CHE) as % Gross Domestic Product (GDP)

	2000	2005	2012	2013	2014	2015	2016
India	4.0	3.8	3.3	3.7	3.6	3.6	3.6
Bangladesh	2.0	2.3	2.6	2.5	2.5	2.5	2.4
Bhutan	4.3	4.0	3.5	3.6	3.5	3.7	3.5
China	4.5	4.1	4.5	4.7	4.8	4.9	5.0
Nepal	3.6	4.5	5.2	5.3	5.8	6.2	6.3
Sri Lanka	4.2	4.0	3.4	3.8	3.6	3.9	3.9
Japan	7.2	7.8	10.8	10.8	10.8	10.9	10.9
United Kingdom	6.0	7.2	8.3	9.8	9.7	9.8	9.8
United States of America	12.5	14.5	16.4	16.3	16.5	16.8	17.1

Source: World Health Organization, Global Health Expenditure Database

Table A 2.1
Association of JSY with mortality

	Infant mortality	Neonatal mortality	Early neonatal mortality	One day mortality	2-28 days mortality	8-28 days mortality
A. Baseline model						
JSY coverage 10-25%	-0.0033**	-0.0017	-0.0011	-0.00090	-0.00084	-0.00027
	(0.0014)	(0.0012)	(0.0010)	(0.00079)	(0.0010)	(0.00049)
JSY coverage 25-50%	-0.0030*	-0.00079	-0.00029	-0.0011	0.000012	-0.000052
	(0.0016)	(0.0013)	(0.0012)	(0.00089)	(0.0011)	(0.00049)
JSY coverage >50%	-0.0040*	-0.0016	-0.0011	-0.0037***	-0.00064	-0.00055
	(0.0021)	(0.0017)	(0.0014)	(0.0012)	(0.0014)	(0.00068)
Observations	409356	409339	409357	409357	409357	409357
B. Baseline model with district and individual covariates						
JSY coverage 10-25%	-0.0018	-0.00045	-0.00037	0.000077	-0.00012	0.000040
	(0.0014)	(0.0012)	(0.0011)	(0.00077)	(0.0011)	(0.00050)
JSY coverage 25-50%	-0.00086	0.00061	0.00046	0.00032	0.00076	0.00049
	(0.0016)	(0.0014)	(0.0012)	(0.00086)	(0.0011)	(0.00051)
JSY coverage >50%	-0.0024	-0.00080	-0.00099	-0.0020*	-0.00047	0.000028
	(0.0022)	(0.0018)	(0.0015)	(0.0012)	(0.0015)	(0.00070)
Observations	405888	405872	405889	405889	405889	405889
Mean of dep. variable at baseline	0.044	0.033	0.024	0.025	0.023	0.0060
No. of districts	587	587	587	587	587	587

Notes: Data are from DLHS-2 and DLHS-3.
Standard errors, corrected for clustering at the district level, are reported in parentheses. Baseline model includes fixed effects for district and year of birth. Model with district and individual controls includes interaction terms of year of birth with the district level poor population, tribal population and wealth as well as individual controls for mother's education, husband's education, mother's age at birth, recall period and dummies for categories of urban dwelling, religion, a multiple birth, and survey round. The unit of observation is a live birth (based on the birth history of a woman). Deviations in sample size are due to missing data.
******* denotes significance at 1%, ** at 5% and * at 10% level.

Table A 2.2
Association of JSY with use of maternal health care services

	Health worker in attendance at delivery	Health Facility Birth	Public Health Facility Birth	Govt/Municipal Hospital	CHC/Rural Hospital	PHC	At least 3 ANC visits
A. Baseline model							
JSY coverage 10-25%	-0.0038	-0.0052	0.000089	-0.00019	0.0024	0.0028	-0.00080
	(0.0055)	(0.0053)	(0.0047)	(0.0043)	(0.0017)	(0.0018)	(0.0050)
JSY coverage 25-50%	0.0076	0.010*	0.024***	0.0049	0.011***	0.014***	0.0044
	(0.0065)	(0.0062)	(0.0056)	(0.0046)	(0.0024)	(0.0028)	(0.0061)
JSY coverage >50%	0.071***	0.088***	0.12***	0.032***	0.046***	0.056***	0.0093
	(0.0092)	(0.0095)	(0.0089)	(0.0064)	(0.0048)	(0.0042)	(0.0077)
Observations	342262	341822	342467	342467	342467	342467	342434
B. Baseline model with district and individual covariates							
JSY coverage 10-25%	-0.00093	-0.0017	0.00031	0.00053	0.0026	0.0021	-0.0012
	(0.0050)	(0.0048)	(0.0047)	(0.0042)	(0.0018)	(0.0019)	(0.0048)
JSY coverage 25-50%	0.0072	0.012**	0.019***	0.0054	0.011***	0.0079***	0.0032
	(0.0058)	(0.0056)	(0.0056)	(0.0046)	(0.0025)	(0.0026)	(0.0058)
JSY coverage >50%	0.067***	0.091***	0.11***	0.032***	0.047***	0.047***	0.0071
	(0.0083)	(0.0089)	(0.0090)	(0.0063)	(0.0050)	(0.0039)	(0.0076)
Observations	339319	338885	339525	339525	339525	339525	339490
Mean of dep. variable at baseline	0.52	0.39	0.20	0.14	0.02	0.03	0.44
No. of districts	587	587	587	587	587	587	587

Notes: Data are from DLHS-2 and DLHS-3.

Standard errors, corrected for clustering at the district level, are reported in parentheses. A health worker is in attendance if the birth is in a health facility or at home with a doctor, nurse, midwife, or lady health volunteer. Baseline model includes fixed effects for district and year of birth. Model with district and individual controls includes interaction terms of year of birth with the district level poor population, tribal population and wealth as well as individual controls for mother's education, husband's education, mother's age at birth, recall period and dummies for categories of urban dwelling, religion, a multiple birth, and survey round. The unit of observation is a delivery (most recent only). Deviations in sample size are due to missing data.

******* denotes significance at 1%, ** at 5% and * at 10% level.

Table A 2.3
Association of JSY with unintended outcomes

	Public Health Facility Birth	Private Facility	Breast Feeding within 1hr	Breast Feeding within 24hr
A. Baseline model				
JSY coverage 10-25%	0.000089	-0.0056	0.015**	-0.014
	(0.0047)	(0.0040)	(0.0069)	(0.012)
JSY coverage 25-50%	0.024***	-0.014***	0.021**	-0.015
	(0.0056)	(0.0042)	(0.0085)	(0.015)
JSY coverage >50%	0.12***	-0.036***	0.076***	0.011
	(0.0089)	(0.0050)	(0.011)	(0.019)
Observations	342467	342467	334968	334968
B. Baseline model with district and individual covariates				
JSY coverage 10-25%	0.00031	-0.0025	0.012*	-0.017
	(0.0047)	(0.0040)	(0.0070)	(0.011)
JSY coverage 25-50%	0.019***	-0.0076*	0.015*	-0.028**
	(0.0056)	(0.0041)	(0.0086)	(0.014)
JSY coverage >50%	0.11***	-0.024***	0.067***	-0.019
	(0.0090)	(0.0049)	(0.012)	(0.018)
Observations	339525	339525	332123	332123
Mean of dep. variable at baseline	0.20	0.18	0.31	0.43
No. of districts	587	587	587	587

Notes: Data are from DLHS-2 and DLHS-3.
Standard errors, corrected for clustering at the district level, are reported in parentheses. Baseline model includes fixed effects for district and year of birth. Model with district and individual controls includes interaction terms of year of birth with the district level poor population, tribal population and wealth as well as individual controls for mother's education, husband's education, mother's age at birth, recall period and dummies for categories of urban dwelling, religion, a multiple birth, and survey round. The unit of observation is a delivery (most recent only). Deviations in sample size are due to missing data.
******* denotes significance at 1%, ** at 5% and * at 10% level.

Table A 2.4
Association of JSY coverage (linear and quadratic) with mortality

	Infant mortality	Neonatal mortality	Early neonatal mortality	One day mortality
A. Baseline model				
JSY coverage	-0.098***	-0.12***	-0.0018	-0.0048***
	(0.037)	(0.037)	(0.0030)	(0.0018)
$(\text{JSY coverage})^2$	0.10***	0.11***	-0.011***	-0.0033**
	(0.038)	(0.039)	(0.0027)	(0.0016)
Observations	1856202	1831872	1842369	1842369
B. Baseline model including district and individual covariates				
JSY coverage	-0.096***	-0.11***	0.0022	-0.0010
	(0.036)	(0.037)	(0.0027)	(0.0017)
$(\text{JSY coverage})^2$	0.11***	0.11***	-0.0072***	-0.0014
	(0.036)	(0.036)	(0.0024)	(0.0015)
Observations	1827920	1804550	1817486	1817486
Mean of dep. variable at baseline	0.044	0.033	0.024	0.025
No. of districts	587	587	587	587

Notes: Data are from DLHS-2, DLHS-3, DLHS-4 and AHS (2010-12)
Standard errors, corrected for clustering at the district level, are reported in parentheses. Baseline model includes fixed effects for district and year of birth. The model with district and individual controls includes interaction terms of year of birth with the district level poor population, tribal population and wealth as well as individual controls for mother's education, mother's age at birth, recall period and dummies for categories of urban dwelling, religion, a multiple births, and survey round. The unit of observation is a delivery (most recent only). Deviations in sample size are due to missing data.
******* denotes significance at 1%, ** at 5% and * at 10% level.

Table A 2.5

Association of JSY coverage (linear and quadratic) with service uptake and breastfeeding

	Health worker in attendance at delivery	Health Facility Birth	Public Health Facility Birth	Private Facility	At least 3 ANC visits	Breast Feeding within 1hr	Breast Feeding within 24hr
A. Baseline model							
JSY coverage	-0.11***	-0.13***	-0.11***	-0.035**	-0.31***	-0.045	0.11***
	(0.032)	(0.030)	(0.031)	(0.017)	(0.038)	(0.039)	(0.037)
(JSY coverage)^2	0.30***	0.27***	0.28***	-0.022	0.37***	0.16***	0.059*
	(0.033)	(0.031)	(0.032)	(0.015)	(0.037)	(0.036)	(0.036)
Observations	1847452	1846465	1859100	1859100	1755818	1837859	1837859
B. Baseline model with district and individual covariates							
JSY coverage	-0.12***	-0.16***	-0.16***	-0.013	-0.29***	-0.075*	0.055
	(0.027)	(0.027)	(0.030)	(0.017)	(0.036)	(0.040)	(0.036)
(JSY coverage)^2	0.26***	0.28***	0.29***	-0.013	0.36***	0.15***	0.041
	(0.027)	(0.029)	(0.032)	(0.015)	(0.035)	(0.036)	(0.033)
Observations	1819333	1818356	1830783	1830783	1729670	1811736	1811736
Mean of dep. variable at baseline	0.52	0.39	0.20	0.18	0.44	0.31	0.43
No. of districts	587	587	587	587	587	587	587

Notes: Data are from DLHS-2, DLHS-3, DLHS-4 and AHS (2010-12)

Standard errors, corrected for clustering at the district level, are reported in parentheses. A health worker is in attendance if the birth is in a health facility or at home with a doctor, nurse, midwife, or lady health volunteer. Baseline model includes fixed effects for district and year of birth. The model with district and individual controls includes interaction terms of year of birth with the district level poor population, tribal population and wealth as well as individual controls for mother’s education, mother’s age at birth, recall period and dummies for categories of urban dwelling, religion, a multiple births, and survey round. The unit of observation is a delivery (most recent only). Deviations in sample size are due to missing data.

******* denotes significance at 1%, ** at 5% and * at 10% level.

Table A 2.6

JSY as a binary treatment and mortality

	Infant mortality	Neonatal mortality	Early neonatal mortality	One day mortality
JSY coverage > 10%	-0.013**	-0.017***	-0.00015	-0.00065
	(0.0058)	(0.0058)	(0.00073)	(0.00043)
Observations	1801576	1778206	1791142	1791142
No. of districts	529	529	529	529

Notes: Data are from DLHS-2, DLHS-3, DLHS-4 and AHS (2010-12)

Standard errors, corrected for clustering at the district level, are reported in parentheses. The model includes fixed effects for district and year of birth. In addition, it includes interaction terms of year of birth with the district level poor population, tribal population and wealth as well as individual controls for mother's education, mother's age at birth, recall period and dummies for categories of urban dwelling, religion, multiple births, and survey round. The unit of observation is a delivery (most recent only). Deviations in sample size are due to missing data.

******* denotes significance at 1%, ** at 5% and * at 10% level.

Table A 2.7
JSY as a binary treatment and service uptake and breastfeeding

	Health worker in attendance at delivery	Health Facility Birth	Public Health Facility Birth	At least 3 ANC visits	Private Facility	Breast Feeding within 1hr	Breast Feeding within 24hr
JSY coverage >10%	0.0038	-0.0043	0.0028	-0.027***	-0.010**	0.011	0.013*
	(0.0059)	(0.0055)	(0.0062)	(0.0067)	(0.0042)	(0.0089)	(0.0076)
Observations	1792931	1792037	1804365	1703553	1804365	1785663	1785663
No. of districts	529	529	529	529	529	529	529

Notes: Data are from DLHS-2, DLHS-3, DLHS-4 and AHS (2010-12)
Standard errors, corrected for clustering at the district level, are reported in parentheses. The model includes fixed effects for district and year of birth. In addition, it includes interaction terms of year of birth with the district level poor population, tribal population and wealth as well as individual controls for mother's education, mother's age at birth, recall period and dummies for categories of urban dwelling, religion, multiple births, and survey round. The unit of observation is a delivery (most recent only). Deviations in sample size are due to missing data.
******* denotes significance at 1%, ** at 5% and * at 10% level.

Table A 2.8

Heterogeneity in the effect of the JSY on gender

	Infant mortality	Neonatal mortality	Early neonatal mortality	One day mortality
JSY coverage 10-25%	-0.0098**	-0.012**	0.00029	0.00011
	(0.0046)	(0.0045)	(0.00084)	(0.00061)
JSY coverage 25-50%	-0.016**	-0.019***	0.00076	0.00072
	(0.0069)	(0.0069)	(0.00087)	(0.00060)
JSY coverage >50%	-0.013	-0.022***	-0.00049	-0.00025
	(0.0080)	(0.0081)	(0.00095)	(0.00069)
boy=1	-0.00032	0.0019***	0.0031***	0.0023***
	(0.00084)	(0.00072)	(0.00056)	(0.00056)
JSY coverage 10-25% × boy	-0.00034	-0.000029	-0.0013	-0.0017**
	(0.0016)	(0.0013)	(0.00095)	(0.00076)
JSY coverage 25-50% × boy	0.0026**	0.00039	-0.00059	-0.0020***
	(0.0013)	(0.0011)	(0.00084)	(0.00062)
JSY coverage >50% × boy	0.00051	-0.0016**	-0.0030***	-0.0023***
	(0.00090)	(0.00075)	(0.00057)	(0.00056)
F test	1.84	3.06	13.86	5.96
P value (Prob>F)	0.1388	0.0276	0.0000	0.0005
Observations	1827484	1804122	1817194	1817194
No. of districts	587	587	587	587

Notes: Data are from DLHS-2, DLHS-3, DLHS-4 and AHS (2010-12)

Standard errors, corrected for clustering at the district level, are reported in parentheses. The model includes fixed effects for district and year of birth. In addition, it includes interaction terms of year of birth with the district level poor population, tribal population and wealth as well as individual controls for mother's education, mother's age at birth, recall period and dummies for categories of urban dwelling, religion, multiple births, and survey round. The unit of observation is a delivery (most recent only). Deviations in sample size are due to missing data.

******* denotes significance at 1%, ** at 5% and * at 10% level.

Table A 2.9
Heterogeneity in the effect of the JSY on gender

	Health worker in attendance at delivery	Health Facility Birth	Public Health Facility Birth	Private Facility	At least 3 ANC visits	Breast Feeding within 1hr	Breast Feeding within 24hr
JSY coverage 10-25%	-0.0021	-0.0071	0.0033	-0.012**	-0.023***	0.020**	0.0028
	(0.0066)	(0.0063)	(0.0071)	(0.0049)	(0.0066)	(0.0086)	(0.0077)
JSY coverage 25-50%	0.0033	-0.0034	0.0035	-0.0082	-0.028***	0.0020	0.017*
	(0.0066)	(0.0066)	(0.0073)	(0.0051)	(0.0083)	(0.010)	(0.0094)
JSY coverage >50%	0.048***	0.030***	0.041***	-0.018***	-0.013	0.023*	0.057***
	(0.0079)	(0.0077)	(0.0083)	(0.0053)	(0.0099)	(0.013)	(0.012)
boy=1	0.0042**	0.0040**	-0.0012	0.0053***	-0.00049	-0.0025	0.0022
	(0.0019)	(0.0017)	(0.0017)	(0.0015)	(0.0017)	(0.0019)	(0.0021)
JSY coverage 10-25% × boy	0.0040	0.0053	0.00035	0.0041	-0.0031	-0.0062	0.0093**
	(0.0039)	(0.0041)	(0.0043)	(0.0042)	(0.0041)	(0.0045)	(0.0046)
JSY coverage 25-50% × boy	-0.0012	-0.00053	-0.0086**	0.0065**	0.0018	0.0042	-0.0056
	(0.0028)	(0.0032)	(0.0035)	(0.0032)	(0.0033)	(0.0039)	(0.0038)
JSY coverage >50% × boy	0.0023	0.0027	0.0012	0.00015	0.0039**	0.0013	-0.0055**
	(0.0021)	(0.0019)	(0.0020)	(0.0016)	(0.0019)	(0.0021)	(0.0023)
F test	1.07	0.63	3.15	1.19	1.29	1.20	5.31
P value (Prob>F)	0.3619	0.5943	0.0245	0.3128	0.2785	0.3088	0.0013
Observations	1818747	1817774	1830197	1830197	1729168	1811237	1811237
No. of districts	587	587	587	587	587	587	587

Notes: Data are from DLHS-2, DLHS-3, DLHS-4 and AHS (2010-12)
Standard errors, corrected for clustering at the district level, are reported in parentheses. The model includes fixed effects for district and year of birth. In addition, it includes interaction terms of year of birth with the district level poor population, tribal population and wealth as well as individual controls for mother's education, mother's age at birth, recall period and dummies for categories of urban dwelling, religion, multiple births, and survey round. The unit of observation is a delivery (most recent only). Deviations in sample size are due to missing data.
******* denotes significance at 1%, ** at 5% and * at 10% level.

Table A 2.10

District Correlates of JSY Coverage

Dependent Variable: JSY coverage	(1)	(2)	(3)	(4)	(5)
Average wealth	-0.133***	-0.121***	-0.119***	-0.0202	-0.0216
	(0.00930)	(0.00974)	(0.0101)	(0.0148)	(0.0155)
Share of poor population		0.113***	0.114***	0.0971**	0.0950**
		(0.0303)	(0.0303)	(0.0474)	(0.0479)
Share of tribal population			0.0165	0.0839***	0.0843***
			(0.0221)	(0.0301)	(0.0302)
Government facility share of birth at baseline					0.0128
					(0.0416)
State Fixed Effects	No	No	No	Yes	Yes
Observations	1,761	1,761	1,761	1,761	1,761

Notes: Data are from the DLHS-3

Standard errors are reported in parentheses. The dependent variable is JSY coverage. The unit of observation is a district-year over the period 2005/2006 to 2007/2008. Government facility share of births is measured at baseline (2004/2005).

*** denotes significance at 1%, ** at 5%, and * at 10% level.

Table A 2.11
Association of JSY and mortality (for all births of a woman)

A. Baseline model				
	Infant mortality	Neonatal mortality	Early neonatal mortality	One day mortality
JSY coverage 10-25%	-0.012**	-0.014***	-0.00062	-0.0011*
	(0.0053)	(0.0053)	(0.00086)	(0.00059)
JSY coverage 25-50%	-0.021***	-0.025***	-0.0029***	-0.0031***
	(0.0075)	(0.0075)	(0.0010)	(0.00064)
JSY coverage >50%	-0.019***	-0.030***	-0.010***	-0.0067***
	(0.0065)	(0.0066)	(0.0010)	(0.00074)
Observations	1872407	1846841	1856587	1856587

B. Baseline model with individual and district covariates				
	Infant mortality	Neonatal mortality	Early neonatal mortality	One day mortality
JSY coverage 10-25%	-0.011**	-0.013**	-0.00052	-0.00077
	(0.0052)	(0.0052)	(0.00087)	(0.00060)
JSY coverage 25-50%	-0.018**	-0.022***	-0.00000036	-0.00035
	(0.0081)	(0.0081)	(0.00092)	(0.00064)
JSY coverage >50%	-0.016*	-0.027***	-0.0024**	-0.00046
	(0.0092)	(0.0093)	(0.0011)	(0.00078)
Mean of dep. variable at baseline	0.044	0.033	0.024	0.025
Observations	1843580	1819033	1831266	1831266
Number of districts	587	587	587	587

Notes: Data are from DLHS-2, DLHS-3, DLHS-4 and AHS (2010-12)
Standard errors, corrected for clustering at the district level, are reported in parentheses. Baseline model includes fixed effects for district and year of birth. The model with district and individual controls includes interaction terms of year of birth with the district level poor population, tribal population and wealth as well as individual controls for mother's education, mother's age at birth, recall period and dummies for categories of urban dwelling, religion, a multiple births, and survey round. The unit of observation is a live birth (based on the birth history of a woman). Deviations in sample size are due to missing data.
******* denotes significance at 1%, ** at 5% and * at 10% level.

Table A 2.12
Association of JSY and health services utilization and breastfeeding
(for all births of a woman)

	Health worker in attendance at delivery	Health Facility Birth	Public Health Facility Birth	Private Facility	At least 3 ANC visits	Breast Feeding within 1hr	Breast Feeding within 24hr
A. Baseline model							
JSY coverage 10-25%	0.00078	-0.0022	0.0041	-0.0085*	-0.029***	0.020**	0.013*
	(0.0064)	(0.0060)	(0.0063)	(0.0044)	(0.0068)	(0.0083)	(0.0075)
JSY coverage 25-50%	0.016*	0.0055	0.015**	-0.015***	-0.030***	0.022**	0.032***
	(0.0083)	(0.0073)	(0.0078)	(0.0047)	(0.0088)	(0.0098)	(0.0095)
JSY coverage >50%	0.11***	0.068***	0.092***	-0.041***	-0.0029	0.070***	0.11***
	(0.0092)	(0.0084)	(0.0088)	(0.0052)	(0.0095)	(0.012)	(0.013)
Observations	1861141	1860545	1873120	1873120	1787584	1849090	1849090
B. Baseline model with individual and district level covariates							
JSY coverage 10-25%	0.0030	-0.0015	0.0045	-0.0079*	-0.026***	0.016*	0.0070
	(0.0060)	(0.0059)	(0.0063)	(0.0042)	(0.0063)	(0.0081)	(0.0076)
JSY coverage 25-50%	0.0096	0.00024	-0.0016	-0.0017	-0.029***	-0.00052	0.017*
	(0.0070)	(0.0067)	(0.0072)	(0.0046)	(0.0087)	(0.0099)	(0.0096)
JSY coverage >50%	0.067***	0.044***	0.041***	-0.0081	-0.0077	0.016	0.060***
	(0.0081)	(0.0078)	(0.0082)	(0.0053)	(0.011)	(0.013)	(0.013)
Observations	1832542	1831950	1844319	1844319	1760724	1822475	1822475
Mean of dep. variable at baseline	0.52	0.39	0.20	0.18	0.44	0.31	0.43
No. of districts	587	587	587	587	587	587	587

Notes: Data are from DLHS-2, DLHS-3, DLHS-4 and AHS (2010-12)
Standard errors, corrected for clustering at the district level, are reported in parentheses. A health worker is in attendance if the birth is in a health facility or at home with a doctor, nurse, midwife, or lady health volunteer. Baseline model includes fixed effects for district and year of birth. The model with district and individual controls includes interaction terms of year of birth with the district level poor population, tribal population and wealth as well as individual controls for mother's education, mother's age at birth, recall period and dummies for categories of urban dwelling, religion, a multiple births, and survey round. The unit of observation is a live birth (based on the birth history of a woman). Deviations in sample size are due to missing data.
******* denotes significance at 1%, ** at 5% and * at 10% level.

Table A 3.1
Association of ASHA coverage (linear and quadratic) with mortality

	Infant mortality	Neonatal mortality	Early neonatal mortality	One day mortality
A. Baseline model				
ASHA coverage	-0.034*	-0.039**	0.00056	-0.0063***
	(0.020)	(0.020)	(0.0025)	(0.0017)
$(\text{ASHA coverage})^2$	0.0097	0.021	-0.00084	0.0081***
	(0.019)	(0.019)	(0.0029)	(0.0020)
Observations	1857029	1832699	1843196	1843196
B. Baseline model including district and individual covariates				
ASHA coverage	-0.015	-0.027	-0.0041*	-0.0064***
	(0.021)	(0.021)	(0.0024)	(0.0017)
$(\text{ASHA coverage})^2$	-0.0076	0.0087	0.0046*	0.0084***
	(0.021)	(0.021)	(0.0027)	(0.0019)
Observations	1828743	1805373	1818309	1818309
No. of districts	587	587	587	587

Notes: Data are from DLHS-2, DLHS-3, DLHS-4 and AHS (2010-12)
Standard errors, corrected for clustering at the district level, are reported in parentheses. Baseline model includes fixed effects for district and year of birth. The model with district and individual controls includes interaction terms of year of birth with the district level poor population, tribal population and wealth as well as individual controls for mother's education, mother's age at birth, recall period and dummies for categories of urban dwelling, religion, a multiple births, and survey round. The unit of observation is a delivery (most recent only). Deviations in sample size are due to missing data.
******* denotes significance at 1%, ** at 5% and * at 10% level.

Table A 3.2
Association of ASHA coverage (linear and quadratic) with service uptake and breastfeeding

	Health worker in attendance at delivery	Health Facility Birth	Public Health Facility Birth	At least 3 ANC visits	Private Facility	Breast Feeding within 1hr	Breast Feeding within 24hr
A. Baseline model							
ASHA coverage	0.28***	0.25***	0.32***	0.27***	-0.094***	0.32***	0.20***
	(0.039)	(0.035)	(0.032)	(0.047)	(0.022)	(0.051)	(0.048)
(ASHA coverage)^2	-0.28***	-0.14***	-0.20***	-0.26***	0.11***	-0.24***	-0.40***
	(0.050)	(0.044)	(0.044)	(0.060)	(0.030)	(0.076)	(0.071)
Observations	1848288	1847296	1859936	1756520	1859936	1838690	1838690
B. Baseline model including individual and district level covariates							
ASHA coverage	0.26***	0.29***	0.41***	0.27***	-0.14***	0.26***	0.18***
	(0.034)	(0.034)	(0.033)	(0.044)	(0.023)	(0.056)	(0.055)
(ASHA coverage)^2	-0.27***	-0.18***	-0.30***	-0.25***	0.18***	-0.18**	-0.39***
	(0.044)	(0.043)	(0.045)	(0.059)	(0.031)	(0.081)	(0.078)
Observations	1820165	1819183	1831615	1730368	1831615	1812563	1812563
No. of districts	587	587	587	587	587	587	587

Notes: Data are from DLHS-2, DLHS-3, DLHS-4 and AHS (2010-12)
Standard errors, corrected for clustering at the district level, are reported in parentheses. A health worker is in attendance if the birth is in a health facility or at home with a doctor, nurse, midwife, or lady health volunteer. Baseline model includes fixed effects for district and year of birth. The model with district and individual controls includes interaction terms of year of birth with the district level poor population, tribal population and wealth as well as individual controls for mother's education, mother's age at birth, recall period and dummies for categories of urban dwelling, religion, a multiple births, and survey round. The unit of observation is a delivery (most recent only). Deviations in sample size are due to missing data.
******* denotes significance at 1%, ** at 5% and * at 10% level.

Table A 3.3
ASHA as a binary treatment and mortality

	Infant mortality	Neonatal mortality	Early neonatal mortality	One day mortality
ASHA coverage>10%	-0.0089**	-0.0076*	0.0016***	-0.0015***
	(0.0040)	(0.0040)	(0.00049)	(0.00035)
Observations	1802383	1779013	1791949	1791949
No. of districts	529	529	529	529

Notes: Data are from DLHS-2, DLHS-3, DLHS-4 and AHS (2010-12)
Standard errors, corrected for clustering at the district level, are reported in parentheses. The model includes fixed effects for district and year of birth. In addition, it includes interaction terms of year of birth with the district level poor population, tribal population and wealth as well as individual controls for mother's education, mother's age at birth, recall period and dummies for categories of urban dwelling, religion, multiple births, and survey round. The unit of observation is a delivery (most recent only). Deviations in sample size are due to missing data.
******* denotes significance at 1%, ** at 5% and * at 10% level.

Table A 3.4

ASHA as a binary treatment and service uptake and breastfeeding

	Health worker in attendance at delivery	Health Facility Birth	Public Health Facility Birth	At least 3 ANC visits	Private Facility	Breast Feeding within 1hr	Breast Feeding within 24hr
ASHA coverage>10%	-0.026***	-0.0045	0.0090*	0.0029	-0.011***	0.019***	0.023***
	(0.0052)	(0.0047)	(0.0050)	(0.0053)	(0.0029)	(0.0066)	(0.0068)
Observations	1793747	1792848	1805181	1704237	1805181	1786474	1786474
No. of districts	529	529	529	529	529	529	529

Notes: Data are from DLHS-2, DLHS-3, DLHS-4 and AHS (2010-12)

Standard errors, corrected for clustering at the district level, are reported in parentheses. The model includes fixed effects for district and year of birth. In addition, it includes interaction terms of year of birth with the district level poor population, tribal population and wealth as well as individual controls for mother's education, mother's age at birth, recall period and dummies for categories of urban dwelling, religion, multiple births, and survey round. The unit of observation is a delivery (most recent only). Deviations in sample size are due to missing data. ******* denotes significance at 1%, ** at 5% and * at 10% level.

Table A 3.5
Heterogeneity in the effect of the ASHA on gender

	Infant mortality	Neonatal mortality	One day mortality
ASHA coverage <5%	-0.0082**	-0.0063	-0.0013***
	(0.0039)	(0.0039)	(0.00039)
ASHA coverage 5-20%	-0.0077*	-0.0077*	-0.00085**
	(0.0046)	(0.0046)	(0.00039)
ASHA coverage >20%	-0.010**	-0.011**	-0.0014***
	(0.0052)	(0.0052)	(0.00042)
boy=1	0.00022	0.00091***	0.00076***
	(0.00041)	(0.00030)	(0.00021)
ASHA coverage <5% × boy	-0.00021	0.00028	-0.00017
	(0.00086)	(0.00066)	(0.00032)
ASHA coverage 5-20% × boy	-0.000056	-0.000058	-0.00072***
	(0.00065)	(0.00044)	(0.00024)
ASHA coverage >20% × boy	0.00020	-0.00082**	-0.00072***
	(0.00054)	(0.00034)	(0.00022)
F test	0.13	4.34	5.42
P value (Prob>F)	0.9445	0.0049	0.0011
Observations	1828307	1804945	1818017
No. of districts	587	587	587

Notes: Data are from DLHS-2, DLHS-3, DLHS-4 and AHS (2010-12)
Standard errors, corrected for clustering at the district level, are reported in parentheses. The model includes fixed effects for district and year of birth. In addition, it includes interaction terms of year of birth with the district level poor population, tribal population and wealth as well as individual controls for mother's education, mother's age at birth, recall period and dummies for categories of urban dwelling, religion, multiple births, and survey round. The unit of observation is a delivery (most recent only). Deviations in sample size are due to missing data.
******* denotes significance at 1%, ** at 5% and * at 10% level.

Table A 3.6
Heterogeneity in the effect of the ASHA on gender

	(1) Health worker in attendance at delivery	(2) Health Facility Birth	(3) Public Health Facility Birth	(2) Private Facility	(7) At least 3 ANC visits	(3) Breast Feeding within 1hr	(4) Breast Feeding within 24hr
ASHA coverage <5%	-0.042***	-0.019***	-0.0080*	-0.0080**	-0.011**	0.0049	0.016**
	(0.0049)	(0.0047)	(0.0048)	(0.0033)	(0.0055)	(0.0065)	(0.0067)
ASHA coverage 5-20%	-0.014**	0.0018	0.017***	-0.015***	0.013**	0.024***	0.028***
	(0.0060)	(0.0053)	(0.0056)	(0.0034)	(0.0061)	(0.0074)	(0.0077)
ASHA coverage >20%	0.018**	0.050***	0.072***	-0.023***	0.042***	0.057***	0.025**
	(0.0079)	(0.0072)	(0.0074)	(0.0046)	(0.0085)	(0.010)	(0.011)
boy=1	0.0068***	0.0066***	-0.00044	0.0062***	0.0024**	-0.0031***	0.000045
	(0.0012)	(0.0011)	(0.0012)	(0.00086)	(0.0011)	(0.0012)	(0.0012)
ASHA coverage <5% × boy	0.0010	0.00029	0.0014	0.00060	0.00076	0.0052**	-0.0030
	(0.0020)	(0.0024)	(0.0025)	(0.0021)	(0.0025)	(0.0025)	(0.0025)
ASHA coverage 5-20% × boy	0.0015	0.0029	0.0015	0.00038	0.0017	-0.00018	-0.0011
	(0.0017)	(0.0018)	(0.0019)	(0.0015)	(0.0018)	(0.0020)	(0.0019)
ASHA coverage >20% × boy	-0.0045**	-0.0039**	-0.0034*	-0.0011	-0.0012	0.0037*	-0.0049***
	(0.0018)	(0.0019)	(0.0020)	(0.0012)	(0.0018)	(0.0020)	(0.0018)
F test	4.88	4.19	2.22	0.51	0.74	2.47	2.54
P value (Prob>F)	0.0023	0.0060	0.0845	0.6742	0.5305	0.0606	0.0559
Observations	1819579	1818601	1831029	1831029	1729866	1812064	1812064
No. of districts	587	587	587	587	587	587	587

Notes: Data are from DLHS-2, DLHS-3, DLHS-4 and AHS (2010-12)
Standard errors, corrected for clustering at the district level, are reported in parentheses. The model includes fixed effects for district and year of birth. In addition, it includes interaction terms of year of birth with the district level poor population, tribal population and wealth as well as individual controls for mother's education, mother's age at birth, recall period and dummies for categories of urban dwelling, religion, multiple births, and survey round. The unit of observation is a delivery (most recent only). Deviations in sample size are due to missing data.
******* denotes significance at 1%, ** at 5% and * at 10% level.

Table A 3.7
District Correlates of ASHA Coverage

Dependent Variable: ASHA coverage	(1)	(2)	(3)	(4)	(5)
Average wealth	-0.0249***	-0.0262***	-0.0234***	-0.00406	-0.00485
	(0.00222)	(0.00234)	(0.00241)	(0.00314)	(0.00329)
Share of poor population		-0.0131*	-0.0129*	0.0206**	0.0194*
		(0.00727)	(0.00723)	(0.0101)	(0.0102)
Share of tribal population			0.0236***	0.0324***	0.0326***
			(0.00527)	(0.00639)	(0.00639)
Government facility share of birth at baseline					0.00711
					(0.00882)
State Fixed Effects	No	No	No	Yes	Yes
Observations	1,761	1,761	1,761	1,761	1,761

Notes: Data are from the DLHS-3

Standard errors are reported in parentheses. The dependent variable ASHA coverage. The unit of observation is a district-year over the period 2005/2006 to 2007/2008. Government facility share of births is measured at baseline (2004/2005).

*** denotes significance at 1%, ** at 5%, and * at 10% level.

Table A 3.8
Association of ASHA and mortality (for all births of a woman)

	Infant mortality	Neonatal mortality	One day mortality
A. Baseline model			
ASHA coverage <5%	-0.0088	-0.0052	0.0026***
	(0.0058)	(0.0059)	(0.00040)
ASHA coverage 5-20%	-0.012*	-0.010	0.0020***
	(0.0069)	(0.0069)	(0.00041)
ASHA coverage >20%	-0.018**	-0.016**	0.0011**
	(0.0082)	(0.0083)	(0.00049)
Observations	1873078	1847512	1857258
B. Baseline model including individual and district level covariates			
ASHA coverage <5%	-0.012**	-0.0093*	-0.0035***
	(0.0049)	(0.0050)	(0.00048)
ASHA coverage 5-20%	-0.013**	-0.012**	-0.0034***
	(0.0059)	(0.0059)	(0.00047)
ASHA coverage >20%	-0.017**	-0.017**	-0.0041***
	(0.0068)	(0.0068)	(0.00051)
Observations	1844249	1819702	1831935
Mean of dep. variable at baseline	0.044	0.033	0.025
No. of districts	587	587	587

Notes: Data are from DLHS-2, DLHS-3, DLHS-4 and AHS (2010-12)

Standard errors, corrected for clustering at the district level, are reported in parentheses. Baseline model includes fixed effects for district and year of birth. The model with district and individual controls includes interaction terms of year of birth with the district level poor population, tribal population and wealth as well as individual controls for mother's education, mother's age at birth, recall period and dummies for categories of urban dwelling, religion, a multiple births, and survey round. The unit of observation is a live birth (based on the birth history of a woman). Deviations in sample size are due to missing data.

******* denotes significance at 1%, ** at 5% and * at 10% level.

Table A 3.9
Association of ASHA and health services utilization and breastfeeding (for all births of a woman)

	Health worker in attendance at delivery	Health Facility Birth	Public Health Facility Birth	Private Facility	At least three ANC visits	Breast Feeding within 1hr	Breast Feeding within 24hr
ASHA coverage <5%	-0.087***	-0.056***	-0.056***	0.011***	-0.035***	-0.026***	0.000012
	(0.0051)	(0.0046)	(0.0044)	(0.0026)	(0.0057)	(0.0067)	(0.0061)
ASHA coverage 5-20%	-0.055***	-0.030***	-0.028***	0.0039	-0.0085	-0.0011	0.014**
	(0.0067)	(0.0057)	(0.0055)	(0.0028)	(0.0062)	(0.0077)	(0.0068)
ASHA coverage >20%	-0.023**	0.011	0.021***	-0.0051	0.0095	0.039***	0.016
	(0.0092)	(0.0078)	(0.0074)	(0.0042)	(0.0090)	(0.011)	(0.010)
Observations	1861820	1861221	1873799	1873799	1788196	1849762	1849762
ASHA coverage <5%	-0.063***	-0.036***	-0.013***	-0.017***	-0.019***	0.018***	0.013**
	(0.0050)	(0.0048)	(0.0047)	(0.0030)	(0.0056)	(0.0067)	(0.0067)
ASHA coverage 5-20%	-0.038***	-0.015***	0.012**	-0.026***	0.0030	0.034***	0.025***
	(0.0063)	(0.0057)	(0.0056)	(0.0033)	(0.0064)	(0.0077)	(0.0079)
ASHA coverage >20%	-0.015*	0.027***	0.063***	-0.034***	0.025***	0.068***	0.017
	(0.0082)	(0.0076)	(0.0075)	(0.0046)	(0.0091)	(0.011)	(0.012)
Observations	1833219	1832624	1844996	1844996	1761334	1823145	1823145
Mean of dep. variable at baseline	0.52	0.39	0.20	0.18	0.44	0.31	0.43
No. of districts	587	587	587	587	587	587	587

Notes: Data are from DLHS-2, DLHS-3, DLHS-4 and AHS (2010-12)
Standard errors, corrected for clustering at the district level, are reported in parentheses. A health worker is in attendance if the birth is in a health facility or at home with a doctor, nurse, midwife, or lady health volunteer. Baseline model includes fixed effects for district and year of birth. The model with district and individual controls includes interaction terms of year of birth with the district level poor population, tribal population and wealth as well as individual controls for mother's education, mother's age at birth, recall period and dummies for categories of urban dwelling, religion, a multiple births, and survey round. The unit of observation is a live birth (based on the birth history of a woman). Deviations in sample size are due to missing data.
******* denotes significance at 1%, ** at 5% and * at 10% level.

Table A 4.1
Association of Sub-centre coverage (linear and quadratic) with mortality

	Infant mortality	Neonatal mortality	Early neonatal mortality	One day mortality
A. Baseline model				
SC coverage	0.024	0.017	-0.00037	-0.0010
	(0.018)	(0.019)	(0.0010)	(0.0010)
$(SC\ coverage)^2$	-0.0013	-0.00074	0.00020**	0.00024*
	(0.0013)	(0.0013)	(0.00010)	(0.00013)
Observations	1830656	1806326	1816823	1816823
B. Baseline model including district and individual covariates				
SC coverage	0.029	0.017	-0.0019*	-0.0024**
	(0.021)	(0.021)	(0.0010)	(0.00099)
$(SC\ coverage)^2$	-0.0022*	-0.0014	0.00023**	0.00024**
	(0.0013)	(0.0013)	(0.000092)	(0.00011)
Observations	1802383	1779013	1791949	1791949
No. of districts	529	529	529	529

Notes: Data are from DLHS-2, DLHS-3, DLHS-4 and AHS (2010-12)
Standard errors, corrected for clustering at the district level, are reported in parentheses. Baseline model includes fixed effects for district and year of birth. The model with district and individual controls includes interaction terms of year of birth with the district level poor population, tribal population and wealth as well as individual controls for mother's education, mother's age at birth, recall period and dummies for categories of urban dwelling, religion, a multiple births, and survey round. The unit of observation is a delivery (most recent only). Deviations in sample size are due to missing data.
******* denotes significance at 1%, ** at 5% and * at 10% level.

Table A 4.2
Association of Sub-centre coverage (linear and quadratic) with service uptake and breastfeeding

	Health worker in attendance at delivery	Health Facility Birth	Public Health Facility Birth	At least 3 ANC visits	Private Facility	Breast Feeding within 1hr	Breast Feeding within 24hr
A. Baseline model							
SC coverage	0.015	0.0083	-0.0065	0.069***	0.015*	0.037**	-0.091***
	(0.019)	(0.017)	(0.015)	(0.018)	(0.0081)	(0.018)	(0.022)
(SC coverage)^2	-0.0044**	-0.0035**	-0.0022	-0.0039**	-0.0011*	-0.0046**	0.0017
	(0.0021)	(0.0017)	(0.0014)	(0.0017)	(0.00059)	(0.0020)	(0.0023)
Observations	1821857	1820948	1833489	1730384	1833489	1812588	1812588
B. Baseline model including individual and district level covariates							
SC coverage	0.043***	0.017	0.0066	0.062***	0.0065	0.056***	-0.019
	(0.015)	(0.014)	(0.013)	(0.018)	(0.0077)	(0.018)	(0.019)
(SC coverage)^2	-0.0049***	-0.0031**	-0.0020*	-0.0048**	-0.00076	-0.0040***	0.000000098
	(0.0017)	(0.0014)	(0.0011)	(0.0020)	(0.00058)	(0.0015)	(0.0016)
Observations	1793747	1792848	1805181	1704237	1805181	1786474	1786474
No. of districts	529	529	529	529	529	529	529

Notes: Data are from DLHS-2, DLHS-3, DLHS-4 and AHS (2010-12)
Standard errors, corrected for clustering at the district level, are reported in parentheses. A health worker is in attendance if the birth is in a health facility or at home with a doctor, nurse, midwife, or lady health volunteer. Baseline model includes fixed effects for district and year of birth. The model with district and individual controls includes interaction terms of year of birth with the district level poor population, tribal population and wealth as well as individual controls for mother's education, mother's age at birth, recall period and dummies for categories of urban dwelling, religion, a multiple births, and survey round. The unit of observation is a delivery (most recent only). Deviations in sample size are due to missing data.
******* denotes significance at 1%, ** at 5% and * at 10% level.

Table A 4.3
Sub-centre as a binary treatment and mortality

	Infant mortality	Neonatal mortality	Early neonatal mortality	One day mortality
SC coverage > 0.5	-0.022***	-0.027***	-0.0011	-0.0017**
	(0.0078)	(0.0079)	(0.00084)	(0.00086)
Observations	1802383	1779013	1791949	1791949
No. of districts	529	529	529	529

Notes: Data are from DLHS-2, DLHS-3, DLHS-4 and AHS (2010-12)

Standard errors, corrected for clustering at the district level, are reported in parentheses. The model includes fixed effects for district and year of birth. In addition, it includes interaction terms of year of birth with the district level poor population, tribal population and wealth as well as individual controls for mother's education, mother's age at birth, recall period and dummies for categories of urban dwelling, religion, multiple births, and survey round. The unit of observation is a delivery (most recent only). Deviations in sample size are due to missing data.

******* denotes significance at 1%, ** at 5% and * at 10% level.

Table A 4.4
Sub-centre as a binary treatment and service uptake and breastfeeding

	Health worker in attendance at delivery	Health Facility Birth	Public Health Facility Birth	At least 3 ANC visits	Private Facility	Breast Feeding within 1hr	Breast Feeding within 24hr
SC coverage>0.5	0.0080	-0.022**	-0.029**	-0.011	0.0035	0.00061	0.082***
	(0.011)	(0.011)	(0.012)	(0.0099)	(0.0047)	(0.014)	(0.014)
Observations	1793747	1792848	1805181	1704237	1805181	1786474	1786474
No. of districts	529	529	529	529	529	529	529

Notes: Data are from DLHS-2, DLHS-3, DLHS-4 and AHS (2010-12)
Standard errors, corrected for clustering at the district level, are reported in parentheses. The model includes fixed effects for district and year of birth. In addition, it includes interaction terms of year of birth with the district level poor population, tribal population and wealth as well as individual controls for mother's education, mother's age at birth, recall period and dummies for categories of urban dwelling, religion, multiple births, and survey round. The unit of observation is a delivery (most recent only). Deviations in sample size are due to missing data.
******* denotes significance at 1%, ** at 5% and * at 10% level.

Table A 4.5
Heterogeneity in the effect of the Sub-centre on gender

	Infant mortality	Neonatal mortality	Early neonatal mortality	One day mortality
SC coverage 0.5-1	-0.022***	-0.027***	-0.00081	-0.0016*
	(0.0077)	(0.0078)	(0.00090)	(0.00089)
SC coverage 1-1.5	-0.033***	-0.038***	-0.0019*	-0.0024***
	(0.011)	(0.011)	(0.00099)	(0.00091)
SC coverage >1.5	-0.023	-0.028*	-0.0018	-0.0025**
	(0.015)	(0.015)	(0.0011)	(0.0010)
boy=1	-0.0016	0.00032	0.0015*	0.00083
	(0.0011)	(0.00091)	(0.00087)	(0.00078)
SC coverage 0.5-1×boy	0.0017	0.00031	-0.00077	-0.00045
	(0.0012)	(0.00093)	(0.00089)	(0.00078)
SC coverage 1-1.5 × boy	0.0018	0.00032	-0.00083	-0.00057
	(0.0012)	(0.00093)	(0.00088)	(0.00078)
SC coverage >1.5 × boy	0.0026**	0.00046	-0.00096	-0.00053
	(0.0013)	(0.00100)	(0.00089)	(0.00079)
F test	1.46	0.08	0.47	0.32
P value (Prob>F)	0.2246	0.9696	0.7046	0.8101
Observations	1801949	1778587	1791659	1791659
No. of districts	529	529	529	529

Notes: Data are from DLHS-2, DLHS-3, DLHS-4 and AHS (2010-12)
Standard errors, corrected for clustering at the district level, are reported in parentheses. The model includes fixed effects for district and year of birth. In addition, it includes interaction terms of year of birth with the district level poor population, tribal population and wealth as well as individual controls for mother's education, mother's age at birth, recall period and dummies for categories of urban dwelling, religion, multiple births, and survey round. The unit of observation is a delivery (most recent only). Deviations in sample size are due to missing data.
******* denotes significance at 1%, ** at 5% and * at 10% level.

Table A 4.6
Heterogeneity in the effect of the Sub-centre on gender

	Health worker in attendance at delivery	Health Facility Birth	Public Health Facility Birth	Private Facility	At least 3 ANC visits	Breast Feeding within 1hr	Breast Feeding within 24hr
SC coverage 0.5-1	0.0095	-0.022*	-0.026**	0.0013	-0.0079	0.0025	0.082***
	(0.011)	(0.011)	(0.012)	(0.0048)	(0.010)	(0.014)	(0.014)
SC coverage 1-1.5	0.036***	0.0027	-0.0048	0.0025	0.013	0.025	0.078***
	(0.012)	(0.013)	(0.014)	(0.0063)	(0.014)	(0.017)	(0.016)
SC coverage > 1.5	0.040***	0.010	0.0023	-0.0015	0.022	0.033*	0.053***
	(0.013)	(0.014)	(0.016)	(0.0081)	(0.017)	(0.019)	(0.019)
boy=1	0.0053*	0.0027	-0.0035	0.0055**	0.0050*	-0.0030	0.0026
	(0.0029)	(0.0026)	(0.0028)	(0.0022)	(0.0030)	(0.0023)	(0.0029)
SC coverage 0.5-1 × boy	0.0019	0.0041	-0.000041	0.0033	-0.00096	0.0016	-0.0049
	(0.0031)	(0.0030)	(0.0032)	(0.0023)	(0.0034)	(0.0026)	(0.0031)
SC coverage 1-1.5 × boy	-0.0016	0.0011	0.0019	-0.0016	-0.0045	0.00048	-0.0051
	(0.0030)	(0.0030)	(0.0031)	(0.0024)	(0.0032)	(0.0027)	(0.0032)
SC coverage > 1.5 × boy	0.0019	0.0066**	0.0075**	-0.00043	-0.0023	0.0029	-0.0044
	(0.0032)	(0.0030)	(0.0033)	(0.0024)	(0.0034)	(0.0028)	(0.0032)
F test	2.04	3.07	4.38	4.29	1.61	0.57	0.93
P value (Prob>F)	0.1068	0.0276	0.0047	0.0052	0.1868	0.6321	0.4268
Observations	1793163	1792268	1804597	1804597	1703737	1785977	1785977
No. of districts	529	529	529	529	529	529	529

Notes: Data are from DLHS-2, DLHS-3, DLHS-4 and AHS (2010-12)
Standard errors, corrected for clustering at the district level, are reported in parentheses. The model includes fixed effects for district and year of birth. In addition, it includes interaction terms of year of birth with the district level poor population, tribal population and wealth as well as individual controls for mother's education, mother's age at birth, recall period and dummies for categories of urban dwelling, religion, multiple births, and survey round. The unit of observation is a delivery (most recent only). Deviations in sample size are due to missing data.
******* denotes significance at 1%, ** at 5% and * at 10% level.

Table A 4.7
District correlates of Sub-centre coverage

	(1)	(2)	(3)	(4)	(5)
Average wealth	0.208***	0.205***	0.593***	0.182**	0.165*
	(0.0672)	(0.0708)	(0.0648)	(0.0843)	(0.0868)
Share of poor population		-0.0206	0.00261	-0.427	-0.445
		(0.202)	(0.177)	(0.292)	(0.293)
Share of tribal population			2.817***	2.236***	2.226***
			(0.130)	(0.160)	(0.161)
Government facility share of birth at baseline					0.164
					(0.209)
State Fixed Effect	No	No	No	Yes	Yes
Observations	1,584	1,584	1,584	1,584	1,584

Notes: Data are from the DLHS-3 and DLHS-4 (Facility Survey)
Standard errors are reported in parentheses. The dependent variable is Sub-Centre coverage. The unit of observation is a district-year over the period 2009 to 2011. Government facility share of births is measured at baseline (2004/2005).
*** denotes significance at 1%, ** at 5%, and * at 10% level.