

MATERNAL AND CHILD HEALTH

Strategic Initiatives to Improve Maternal and Child Health in Andhra Pradesh

Cost-Benefit Analysis



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This work has been produced as a part of the Andhra Pradesh Priorities project under the larger, India Consensus project.

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Strategic Initiatives to Improve Maternal and Child Health in Andhra Pradesh: A Cost-Benefit Analysis

Andhra Pradesh Priorities
An India Consensus Prioritization Project

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The authors thank Brad Wong for his useful comments which helped completing the paper to great extent

Working paper as of April 12, 2018

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Academic Abstract

The objective of this paper is to address the issue of maternal and child health in India – specifically in Andhra Pradesh. Despite a significant decrease in infant and maternal mortality rates in the country, India continues to demonstrate among the highest prevalence of neonatal mortality in the world, with about 0.75 million neonates dying every year.

Andhra Pradesh has improved significantly on its maternal and child survival indicators in the last 10 years. Between 2005-06 and 2015-16, Andhra Pradesh's infant mortality fell from 54 to 35 deaths per 1000 live births (NFHS-3, NFHS-4). Maternal mortality rate fell from 134 per 100,000 live births in 2008, to 92 in 2012 (Ministry of Health and Family Welfare, NFHS-4). Nevertheless, there is still room for improvement, particularly on several indicators related to access and use of child and maternal health services. In Andhra Pradesh, 70 percent of women exclusively breastfeed, 76 percent of women had at least 4 antenatal care (ANC) visits during pregnancy, and only 65 percent of children are fully vaccinated (NFHS-4).

A cost-benefit analysis of three policy interventions - breastfeeding promotion, promotion and incentivization of immunizations in lagging districts and conditional cash transfers for accessing ante natal services shows significantly positive benefit-cost ratios (BCRs). The paper argues that the most effective (highest benefits-to-costs) intervention to improve maternal and child health is immunization promotion, while promotion of exclusive breastfeeding to new mothers has the largest net benefits.

Policy Abstract

The Problem

The nomenclature 'Maternal and Child Health' (MCH) itself heralds the interactive nature of human lives and multi-dimensional health care regimes. Since Independence it has been the government's resolve to provide affordable health care access including MCH to the masses. While supply of health care has always been a challenge there are many demand side issues that regulate health seeking behavior, especially in the MCH field. The current survival status of a child is a good indicator of the efficacy of MCH programs. Yet there are many factors relating to mothers such as level of education, frequency of antenatal checkups, place of delivery, length of breastfeeding and place of residence which all independently as well as interactively affect the child's survival. Considerable variation in the supply and demand for MCH services is noticed across India and there is stark differential between states.

Like many parts of the developing world, Andhra Pradesh has improved significantly on its maternal and child survival indicators in the last 10 years. Between 2005-06 and 2015-16 survey data indicate that Andhra Pradesh's infant mortality fell from 54 to 35 deaths per 1000 live births (NFHS 3, NFHS4). Maternal mortality rate fell from 134 per 100,000 live births in 2008, to 92 in 2012 (Ministry of Health and Family Welfare, NFHS-4).

Nevertheless, there is still room for improvement, particularly on several indicators related to access and use of child and maternal health services. In Andhra Pradesh, 70 percent of women exclusively breastfeed, 76 percent of women had at least 4 antenatal care (ANC) visits during pregnancy, and only 65 percent of children are fully vaccinated (NFHS-4).

Existing Initiatives

The government of Andhra Pradesh has taken several steps to ensure the improvement of maternal and child health. The Community Managed Health & Nutrition project is a comprehensive package of community based interventions which include Nutrition cum Day Care Center (NDCC), Health Savings & Health Risk Fund, Convergence of Fixed National Health Day, Water & Sanitation program, Sanjeevani Health Insurance, and Capacity Building of Health Activist (HA), Health Sub Committee (HSC), and Community Resource Person (CRP). The Community Managed Health and Nutrition (CMH&N) intervention utilizes trained community members in the form of Health Activists (HA) and Community Resource Persons

(CRP) to transmit messages about maternal, neonatal, infant care practices to SHGs and village organizations.

To break the cycle of malnutrition in mothers and children, the Society for the Elimination of Rural Poverty (SERP) has created over 4200 Nutrition Day Care Centers (NDCCs) in rural Andhra Pradesh. SERP's mobile (mNDCC) device provides an innovative approach to increase communication between village-level community workers (referred to as health activists) and programme officers at the headquarters.

The programme Bhavita was started by GoAP as Maarpu, to bring about a quick decline in the infant mortality rate, maternal mortality rate and malnutrition in the state. Maarpu mainly focused on the 20 identified key interventions which include early registration of pregnancy; ante natal checkups; maternal nutrition; Identification of high-risk pregnancies; birth planning; institutional delivery; early initiation of breastfeeding; exclusive breastfeeding for six months; post natal care and newborn care; immunization; growth monitoring; complementary feeding & child nutrition; management of ARI & diarrhoea; strengthening of referral system; family planning. This program is directly lead by the district controller in each district.

GoAP has also introduced the Talli-Bidda Express scheme, designed to take care of pregnant women and newborns. The '102' health service was launched in West Godavari district on 1st January 2016. Under the scheme, every mother and her newly born child, after delivery in government hospitals, is transported to her residence along with family members free of cost. The family members concerned have to dial '102', either from cellphone or landline to avail this scheme. The scheme also offers free transport of pregnant women to hospitals in emergency. The government will press into service 270 vehicles under the scheme "Drop Back Service" provided by the state to mothers who have delivered in government maternity hospitals. As hospitals remain inaccessible, pregnant women in remote rural and scheduled areas face life risk at times of deliveries. Poor accessibility also results in a drop in institutional deliveries and this scheme hopes to overcome this particular challenge.

Immunizations are popular and broadly accepted as useful in reducing many types of sickness amongst the infants and children. The cost of immunization is highly subsidized as a pro-poor government policy. They are also found to be highly efficient in terms of benefit-cost ratios (Jamison et al, 2012). The current system of providing immunizations in Andhra via anganwadi centers, primary health care centers and private providers, however, seems

insufficient. As stated, only 65 percent of children are fully immunized across the state. Several districts in Andhra Pradesh lag behind the state average in terms of percentage of full immunization (East Godavari, Sri PottiSriramulu Nellore, Srikakulam and Vizianagaram). The average rate of immunization in these districts is 55 percent.

This paper analyses the impact of three interventions - breastfeeding promotion, promotion of immunizations and conditional cash transfers for accessing ante natal services on child survival. The justification for these interventions was based on logit regression¹ estimations on last-born children (both dead and alive at the time of survey). The mandate was to identify key elements, catalytic in nature within the MCH program which augment and sustain child survival in the state of Andhra Pradesh.

The BCR analysis presented below indicates positive BCRs for all three interventions namely breastfeeding promotion, promotion and incentivization of immunizations in lagging districts and conditional cash transfers for accessing ante natal services. These interventions are designed primarily to foster demand for MCH services, though two of the interventions have supply driven elements (extra staff for breastfeeding promotion, and establishment of immunization camps for lagging areas).

Intervention 1: Mass media promotion and intensive counselling of breastfeeding

Overview

- TV advertisements to be broadcasted (aired) on different TV channels during prime time shows when highest number of audience watch such ads.
- Counselling of mothers who have just given birth or are about to give birth. Dedicated staff (educated and specifically having knowledge of human psychology) must be hired at hospital / PHC level – one for every 120 visiting mothers – who can teach importance of breastfeeding to mothers who make pre-natal visits or those mothers who delivered a baby and are admitted in the hospital.

¹ Regression run on last born children of mothers who were interviewed in IHDS-II survey (2014-15). This analysis (in the appendix) finds that the likelihood (odds in favour) of a child being alive increases by almost 9.43 time higher for those who are breast-fed beyond 19 months than the children who were not breast-fed at all. Impact of prolonged breastfeeding on child mortality is huge; and jointly with early breastfeeding soon after birth, and exclusive breastfeeding for at least 3-4 months yields extraordinary child survival gains in India. Additional independent child survival gains are observed through the frequency of 'antenatal checkups' and 'child immunizations'.

- Mothers will also be provided with printed fliers/ pamphlets which contain the communication material which they are given orally at hospitals.

Implementation Considerations

- Clearly researched oral communication protocols / counselling must be developed so that the mothers are educated during the anti-natal and post-natal periods about the extraordinary benefits of breastfeeding. Existing initiatives in the region, such as *Alive and Thrive*, can be leveraged for this purpose. The prevailing protocols and mechanism of engagements appear inadequate and ineffective. After a careful review of a large amount of literature relating to breast-feeding the authors recommend 17-point interactive communication opportunities between the mother (and child) and health professionals as follows:

Seventeen Point Interactive Breastfeeding Counselling Protocol			
4 times during ANC checks	4 times in the hours and days after birth ²	6 times Every month for 3 months and 3 more time for 9 more months	3 times After one year of age of the child

Source: Authors adapted from Menon et al. (2016)

Costs and Benefits

The dominant positive impact of breastfeeding a ‘behavioral’ factor cannot be overemphasized. Notwithstanding the behavioral characteristics of breastfeeding; information sharing, and promotional campaigns using multi-media such as electronic, audio-visual and print media are essential to ensure extended and exclusive breastfeeding.

Costs

The cost of the intervention is the sum of three categories of costs. The first is the cost of running 30 advertisements per day on 10 local and national news channels for two days a week which yields a total cost of Rs 468 crores. The second is the extra staff cost for intensive counselling, including communications materials, on breastfeeding (to pregnant and new mothers across the health system) by professional counsellors which adds up to Rs. 174 crores. The final set of costs are private costs such as transport, food and time when availing the 17 counselling services. This is Rs. 107 crore. The total annual requirement to promote various components of breastfeeding practices in Andhra Pradesh is therefore Rs. 749 crores per year.

² Counseling is provided to the mother and relatives during intra-partum and post-partum periods.

Benefits

Following similar experiences in Bangladesh, Vietnam, Madagascar, Bolivia and Ghana we estimate that this will increase exclusive breastfeeding from 70 percent to 93 percent, and extended breastfeeding from 48 percent to 88 percent. This will lead to 5,982 fewer child deaths (0-23 month olds) per year, reduce U5 mortality rate from 41 to 34 per 1000 live births and avoid almost 40,000 years lost to disability (YLDs). The benefits at 5 percent discount rate is estimated to be Rs. 5,757 crores.

Intervention 2: Promotion, Incentivization and Supply of Immunization in Lagging Districts

Overview

- Promotion and provision of immunization camps for remote areas, that incentivizes mothers to bring children for immunization

Implementation Considerations

- The intervention will be implemented with in-kind transfers (lentils and meals) worth Rs 685 based on a randomized controlled study from rural Rajasthan (Banerjee et al. 2010).

Costs and Benefits

Costs

The augmented total cost per annum for the immunization camps plus incentives in Andhra Pradesh is Rs. 10 crores, 7.4 crore of which are the incentives. This includes an assumed 70 percent substitution away from the existing system, for those who would have been vaccinated anyway.

Benefits

This intervention is assumed to raise the level of fully immunized children in the districts to the state average 65 percent, saving 219 children per year and avoiding 5,946 YLDs. At 5 percent discounting rate the Benefit-Cost ratio is 37.

Intervention 3: Conditional Cash Transfer for ANC Visits

Overview

- Provision of Rs 2000 for accessing 4 ANC visits during pregnancy

Implementation Considerations

We assume this large incentive will boost uptake of 4 ANC services from 76 percent to 92 percent of women during pregnancy. This is based on similar success of Janani Suraksha Yojana (JSY) program in significantly boosting demand for maternity services (institutional births) in the state.

Costs and Benefits

Costs

The total cost of this intervention is 163 crore, 151 crore for the cash incentives, and 12 crore for health system and private costs of mothers making new ANC visits.

Benefits

We expect this to lead to a reduction in neonatal mortality of 6 per 1000 live births, following similar experiences in India and developing countries. This will save 804 infant lives per year and avert 6,062 YLDs. Benefits are estimated at 950 crore per year (5 percent discount), including 151 crore cash incentive (both a benefit and a cost).

Conclusion

Maternal and Child Health (MCH) outcomes are dependent upon a complicated set of health and wellbeing interventions directed towards two 'primary and biologically' bounded individuals – the mother and the child. Further there are three distinct but inter-related temporal phases that are closely linked – namely 'ante-natal', 'intra-natal' and 'post-natal' periods. However, a multitude of dimensions, such as behavioural, economic, medical, technical, and administrative factors impact the performance of policy interventions.

It is important to note while all interventions do generate great benefits, they may produce many types of externalities not accounted for in this analysis and estimation of benefit-cost ratios. For example, enhanced investments in MCH may also improve health and survival of pregnant and lactating mothers thus reducing maternal mortality. Further, there are many

synergies and mutually beneficial effects of all these three inventions can generate. Such synergistic benefits can be very high and developmental in nature.

BCR Summary Table: Andhra Pradesh

Intervention	Benefits per year (crore)	Costs per year (crore)	BCR	Quality of Evidence
Mass media promotion and intensive counselling of breastfeeding	5,757	749	8	Strong
Promotion, incentivization and supply of immunization in lagging districts	385	10	37	Strong
Conditional cash transfer for ANC visits	950	163	6	Strong

Note: All figures assume a 5 percent discount rate, costs and benefits are in annual Crore INR

Introduction

The healthcare system in India is at a crucial juncture today. Significant progress has been made since Independence through improvement in life expectancy, reduction in infant mortality and crude death rates, effective eradication of diseases such as small-pox and polio and so on (Patel *et al.* 2015). Life expectancy has increased by almost four years over the last ten, from 64.4 years in 2005 to 68.3 years in 2015. The rate of infant mortality has declined from 57 deaths per 1,000 live births in 2005 to 37 deaths per 1,000 live births currently. India's human development index has improved from 0.494 in 2000 to 0.624 in 2015, with the country ranking at 131 out of a total of 188 countries in 2015 - an improvement of 4 ranks from the corresponding 2010 figure. (UNDP, 2016).

However, in spite of these achievements, challenges due to outbreaks of communicable diseases and a rise in incidence of chronic diseases such as cardio vascular disease, cancers and diabetes remain. Further, concerns on maternal mortality and infant mortality remain constant with undue focus on the period of childbirth and not on the pre and postnatal stages. More than 659,000 newborn babies die every year in India – amongst the highest number of newborn deaths in the world. India also accounts for twenty percent of all maternal deaths worldwide, with more than 150 women dying in India each day due to preventable causes related to pregnancy and childbirth.

The 2030 Agenda for Sustainable Development goal number 3 seeks to ensure healthy lives and promote well-being for all at all ages. An important aspect of this goal is the focus on reproductive, maternal, newborn and child health with the aim of reducing maternal and child mortality. Maternal and Child Health (MCH) outcomes are dependent upon a complicated set of health and wellbeing interventions directed towards two 'primary and biologically' bounded individuals – the mother and the child. Further there are three distinct but inter-related temporal phases that are identified and linkages established.

Phase 1: Maternal health, Ante-natal Health and Nutrition

The health of a newly born child and the future labour force is dominantly dependent upon the health and nutrition of the mother for an extended duration of time which goes beyond the gestation period. Maternal health and nutrition, ante-natal checks and consumption of prophylaxis such as iron and folic acid supplementation are essential to ensure health child growth within the womb. A recent study of survey data across 69 low income countries

indicates that ANC visits can significantly reduce child mortality (Kunht and Vollmer, 2017). Efforts, often behavioural by the pregnant woman and her household, and primary health care providers must be in tandem for them to succeed.

Phase 2: Intra-natal Period

The second segment of the MCH puzzle occurs during the time of birth when the child loses the protective cover of the mother's womb and is exposed to multitude of environmental, social and traditional issues. It is but natural that the child faces many health-related situations such as sickness, affliction of disease, trauma, disability etc., which determines the child survival and life expectancy.

Given the complex physical transition that a child must go through during birth, it is important the birth occurs within the environs of a health institution and under the presence and care of trained medical assistance. India faces high incidence of low birth weights (Fadel, Shaza A. et al., 2017) and there must be special care and arrangements, including the availability of incubators, oxygen and other essential health inputs. It is also important that the child is put on exclusive breastfeeding almost immediately after birth – without any delay so that the natural immunological advantages of mother's milk is received by the child.

It is useful to review the analysis and recommendations of 'The Million Death Study (MDS)' which extracts data from the Sample Registration System (SRS). Estimates suggest that 14.3 per cent of all infant deaths and 55 per cent of all neonatal deaths are caused by low birth weight (2015). Three causes — prematurity or low birth weight, neonatal infections, and birth asphyxia or trauma — accounted for more than three-quarters of neonatal deaths in India.

To meet the 2030 Sustainable Development Goals for child mortality, India will need to maintain the current trajectory of 1–59-month mortality and accelerate declines in neonatal mortality (to >5 percent annually) from 2015 onwards. Continued progress in reduction of child mortality due to pneumonia, diarrhea, malaria, and measles at 1–59 months is feasible. Additional attention to low birthweight is required which would occur in fact during the time the mother is growing up (pre-marital phase), married at an age where she is biologically robust and that she is nutritionally and emetically balanced so that the child gets the optimal biological environment for nourishment and growth before birth.

Phase 3: Neonatal and Infancy period

An empirical analysis of the latest unit level (household) data suggests that breastfeeding for a considerably long period of time such as 12-18 months has shown high benefits in the form of child survival (see appendix). The medical literature further emphasizes that the exclusive breastfeeding is essential to ensure safe health of the child during the process of growth (Sankar et al, 2015).

The State of India and Andhra Pradesh

As per NFHS-4, percentage of mothers who had antenatal check-up in first trimester increased in India from 43.9% in 2005-06 (NFHS-3) to 58.6% in 2015-16. Percentage of mothers who had antenatal check-up in first trimester in rural areas was 54.2% in 2015-16 and in urban areas, percentage of mothers who had antenatal check-up in first trimester was 69.1% in 2015-16. In comparison, Andhra Pradesh has improved significantly on its maternal and child survival indicators in the last 10 years. Between 2005-06 and 2015-16 survey data indicate that Andhra Pradesh's infant mortality fell from 54 to 35 deaths per 1000 live births (NFHS 3, NFHS4). Maternal mortality rate fell from 134 per 100,000 live births in 2008, to 92 in 2012 (Ministry of Health and Family Welfare, NFHS-4).

Nevertheless, there is still room for improvement, particularly on several indicators related to access and use of child and maternal health services. In Andhra Pradesh, 70 percent of women exclusively breastfeed, 76 percent of women had at least 4 antenatal care (ANC) visits during pregnancy, and only 65 percent of children are fully vaccinated (NFHS-4).

The government of Andhra Pradesh has taken several steps to ensure the improvement of maternal and child health. The Community Managed Health & Nutrition project is a comprehensive package of community based interventions which include Nutrition cum Day Care Center (NDCC), Health Savings & Health Risk Fund, Convergence of Fixed National Health Day, Water & Sanitation program, Sanjeevani Health Insurance, and Capacity Building of Health Activist (HA), Health Sub Committee (HSC), and Community Resource Person (CRP). The Community Managed Health and Nutrition (CMH&N) intervention utilizes trained community members in the form of Health Activists (HA) and Community Resource Persons (CRP) to transmit messages about maternal, neonatal, infant care practices to SHGs and village organizations.

To break the cycle of malnutrition in mothers and children, the Society for the Elimination of Rural Poverty (SERP) has created over 4200 Nutrition Day Care Centers (NDCCs) in rural Andhra Pradesh. SERP's mobile (mNDCC) device provides an innovative approach to increase communication between village-level community workers (referred to as health activists) and programme officers at the headquarters.

The programme Bhavita was started by GoAP as Maarpu, to bring about a quick decline in the infant mortality rate, maternal mortality rate and malnutrition in the state. Maarpu mainly focused on the 20 identified key interventions which include early registration of pregnancy; ante natal checkups; maternal nutrition; Identification of high-risk pregnancies; birth planning; institutional delivery; early initiation of breastfeeding; exclusive breastfeeding for six months; post natal care and newborn care; immunization; growth monitoring; complementary feeding & child nutrition; management of ARI & diarrhoea; strengthening of referral system; family planning. This program is directly lead by the district controller in each district.

GoAP has also introduced the Talli-Bidda Express scheme, designed to take care of pregnant women and newborns. The '102' health service was launched in West Godavari district on 1st January 2016. Under the scheme, every mother and her newly born child, after delivery in government hospitals, is transported to her residence along with family members free of cost. The family members concerned have to dial '102', either from cellphone or landline to avail this scheme. The scheme also offers free transport of pregnant women to hospitals in emergency. The government will press into service 270 vehicles under the scheme "Drop Back Service" provided by the state to mothers who have delivered in government maternity hospitals. As hospitals remain inaccessible, pregnant women in remote rural and scheduled areas face life risk at times of deliveries. Poor accessibility also results in a drop in institutional deliveries and this scheme hopes to overcome this particular challenge.

Immunizations are popular and broadly accepted as useful in reducing many types of sickness amongst the infants and children. The cost of immunization is highly subsidized as a pro-poor government policy. They are also found to be highly efficient in terms of benefit-cost ratios (Jamison et al 2012). The current system of providing immunizations in Andhra via anganwadi centers, primary health care centers and private providers, however, seems insufficient. As stated, only 65 percent of children are fully immunized across the state. Several districts in Andhra Pradesh lag behind the state average in terms of percentage of full immunization

(East Godavari, Sri PottiSriramulu Nellore, Srikakulam and Vizianagaram). The average rate of immunization in these districts is 55 percent.

This paper analyses the impact of three interventions - breastfeeding promotion, promotion of immunizations and conditional cash transfers for accessing ante-natal services on child survival. The justification for these interventions was based on logit regression³ estimations on last-born children (both dead and alive at the time of survey). The mandate was to identify key elements, catalytic in nature within the MCH program which could augment and sustain child survival in the state of Andhra Pradesh. These interventions are designed primarily to foster demand for MCH services, though two of the interventions have supply driven elements (extra staff for breastfeeding promotion, and establishment of immunization camps for lagging areas).⁴

Numerous recent studies lay out current evidence on improvements in maternal and child mortality and health in India and around the world, including Sankar et al (2015), McGovern and Canning, (2015), Kuhnt and Vollmer (2017). The data shows clear patterns in the improvement of infant mortality and health outcomes through use of exclusive breastfeeding practices, immunizations and antenatal care services.

Drawing upon these studies and others, this paper indicates that the most effective (highest benefits-to-costs) intervention is immunization promotion, while promotion of exclusive breastfeeding to new mothers has the largest net benefits.

Breastfeeding Promotion

Background and Evidence

Breastfeeding is as an important factor to promote survival in early childhood (Sankar et al, 2015). It has been found that poor and suboptimal breastfeeding practices, including non-exclusive breastfeeding, contribute to more than 11% of mortality in children under 5 years

³ Regression run on last born children of mothers who were interviewed in IHDS-II survey (2014-15). This analysis (in the appendix) finds that the likelihood (odds in favour) of a child being alive increases by almost 9.43 time higher for those who are breast-fed beyond 19 months than the children who were not breast-fed at all. Impact of prolonged breastfeeding on child mortality is huge; and jointly with early breastfeeding soon after birth, and exclusive breastfeeding for at least 3-4 months yields extraordinary child survival gains in India. Additional independent child survival gains are observed through the frequency of 'antenatal checkups' and 'child immunizations'.

⁴ It should be noted that we are agnostic as to whether the interventions analyzed in this paper should be established as new programs, wrapped up in existing programs mentioned in this section or delivered via related avenues e.g. Village Health Nutrition Days or Yashoda birth companions. The only point to emphasize is that more tasks cannot simply be placed upon the existing health worker cadre, and new real resources will need to be spent to see the improvements suggested in this paper.

of age (Black *et al.*, 2013). Lamberti *et al.* (2013) studied the impact of breastfeeding on the risk of pneumonia morbidity and mortality and found that breastfeeding prevents illnesses and provides essential nutrients for optimal child growth and development during the first two years of life. Chowdhury *et al.* (2013) found that breastfeeding also has several benefits for the mother, improving her health significantly. Victora *et al.*, (2015) studied the impact of breastfeeding on intelligence, educational attainment and income showing that there was a significant positive correlation with long-term effects on IQ and income. The World Health Organization's recommendation is that initiation of breastfeeding should occur within 1 hour of birth, exclusive breastfeeding should be practiced till 6 months of age and breastfeeding should be continued until 2 years of age at the least.

A systematic review in 2015 provided strong evidence that a multitude of interventions combined and delivered through different platforms would be more effective than single interventions (Sinha *et al.*, 2015). The interventions with the greatest effect on exclusive and continued breastfeeding were those that involved both the health system and the community (where the definition of community also included mass media). The study recommended the integration of a combination of strategies using complex adaptive systems for scaling up. (Menon *et al.*, (2016) conducted cluster-randomized impact evaluations in Bangladesh and Viet Nam of intensified and non-intensified interventions to promote breastfeeding. Part of the *Alive and Thrive* programs in each country, these interventions included interpersonal breastfeeding counselling mass media, community mobilization and policy advocacy. They found significant positive impact of the intervention on breastfeeding practices in both the countries, with stronger responses from intensified arms. This study corroborates earlier experiences in Bolivia, Ghana and Madagascar in which mass media promotion of breastfeeding led to significant increase in rates of exclusive breastfeeding (Quinn *et al.*, 2001).

Description of Intervention

This intervention is based on the intensive arm of the Bangladesh experience of *Alive and Thrive* as documented in Menon *et al.* (2016). To spread awareness about the importance of breastfeeding, two programs are proposed. Firstly, TV advertisements are broadcasted on different TV channels during prime time shows when highest number of viewers is exposed to such ads. Menon *et al.* (2016) describes that in Bangladesh, 24 ads were shown on the 3rd

day of each week for four channels, for a total number of TV ads of 96 per week. They also state that radio stories were broadcast across four stations, plus additional community based video, quizzes, dialogues and policy advocacy were implemented, though do not indicate the frequency of these elements of the program. In this analysis, we assume 30 ads of 30 seconds length will be broadcast two days per week on 10 national and regional TV channels in Andhra Pradesh. This implies 600 ads of 30 seconds each per week - significantly higher rate of advertisement than in Bangladesh, but also without radio stories or additional community engagement.

The second aspect is to educate and psychologically condition mothers about the importance of breastfeeding. Dedicated staff (educated and specifically having knowledge of human psychology) must be hired at hospital / PHC level – one for every 120 visiting mothers – who can teach the importance of breastfeeding to mothers who make pre-natal visits or those mothers who delivered a baby and are admitted in the hospital. They will also be provided with printed fliers/ pamphlets which contain the communication material which is given orally at health care facilities. Clearly researched oral communication protocols / counselling must be developed so that the mothers are educated during the anti-natal and post-natal periods about the extraordinary benefits of breastfeeding. The prevailing protocols and mechanism of engagements appear inadequate and ineffective.

After a careful review of a large amount of literature relating to breast-feeding we recommend 17-point interactive communication opportunities between the mother (and child) and the professionals as follows:

Seventeen Point Interactive Breastfeeding Counselling Protocol			
4 times during ANC checks	4 times in the hours and days after birth ⁵	6 times Every month for 3 months and 3 more time for 9 more months	3 times After one year of age of the child

Source: Authors adapted from Menon et al (2016).

In a given year we estimate there are 8.2 lakh women giving birth per year. This is based on an assumed population of 542 lakhs (Copenhagen Consensus project assumption based on Census 2011) and a crude birth rate of 15 per 1000 (Registrar General of India’s office).

⁵ Counseling is provided to the mother and relatives during intra-partum and post-partum periods.

Calculation of Costs and Benefits

Costs

The cost of TV Ads is calculated by assuming that each second of air time costs 5000 rupees. For 600 ads per week, this amounts to 468 crore per year.

For estimating the cost of counselling in hospitals and PHCs, it is assumed that one professional staff will be on average counselling 8 pregnant women each day for one hour each. For the 17 points of contact and 250 working days per year, this implies 6962 additional counselors need to be hired. Professional salaries of these individuals are assumed to be Rs. 20,000. Also, a printed pamphlet needs to be given to each woman after each counselling session and cost of one pamphlet is estimated at 5 rupees. Total costs for counselling are therefore estimated at Rs. 174 crore per year.

The final cost is that of the caregiver's time. We assume 2 hours per visit including travel time, and apply 50% of the daily wage rate of Rs 286 (Copenhagen Consensus assumption based on NSS 68). An additional Rs 41 to account for travel costs and food is included for each counselling visit (NSS 71). For the 17 visits, the cost equals 107 crore per year for all mothers of newborns in the state.

The total cost from the intervention is 749 crore per year.

Benefits

The findings from Menon et al (2016) indicate that after the intensive treatment of breastfeeding promotion, rates of exclusive breastfeeding increased substantially from 48.5% to 87.6%. This implies a reduction of 76% in the 'breastfeeding gap' i.e. those mothers who do not exclusively breastfeed. We apply that same effect to the breastfeeding gap in Andhra Pradesh. Currently 30% of women in the state do not exclusively breastfeed and 52% of women do not continually breastfeed up to 23 months (NFHS-4, IHD2). As a result of the intervention we assume that rates of exclusive breastfeeding will reach 93% and extended breastfeeding will reach 88%. This implies an additional 1.9 lakh children more who will be exclusively breastfed, and 3.22 lakh who will be breastfed between 6-23 months.

Sankar et al (2015) undertake a meta-analysis of studies examining the relationship between breastfeeding and child mortality. They document a 49% reduction in mortality when moving from partial breastfeeding to exclusive breastfeeding and a 46% reduction in mortality when moving from limited breastfeeding between 6-23 months to continuous breastfeeding to 23 months. We use these effect sizes to estimate the avoided infant mortality and morbidity from increased breastfeeding. The intervention will avoid 5,982 child deaths and 39,851 YLDs per year.

We value lives saved by converting each death to avoided DALYs (discounted at the appropriate rate). For an infant this implies 19.3 DALYs avoided at a 5% discount rate. Each DALY is valued at 3x GDP per capita as per Copenhagen Consensus assumptions (i.e. Rs 3.7 lakh). YLDs are also valued at the same rate. The total benefit is therefore 5,757 at a 5% discount rate. The benefit to cost ratio is 8.

Infant and Child Immunization

Background and Evidence

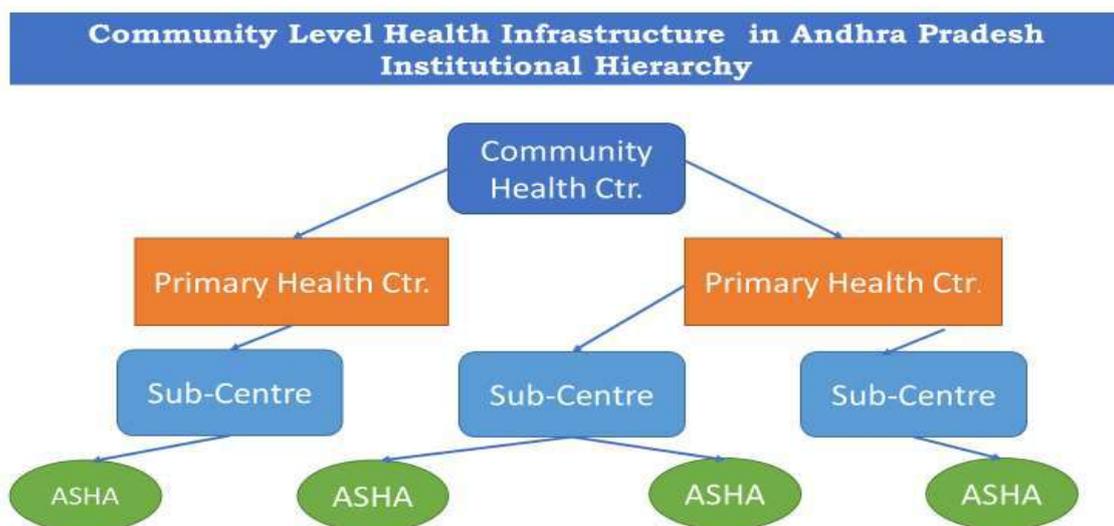
Historically, immunizations are the most cost-efficient interventions the medical system has found in reducing infant and childhood mortality. Several studies have shown the value of incentives for improving immunization uptake. Robertson *et al.*, (2013) studied the impact of cash transfers on immunization uptake in Zimbabwe and found that there was a significant improvement of immunization. In a clustered randomized controlled evaluation of incentivized and non-incentivized immunization campaigns in rural Rajasthan, Banerjee et al (2010) found that small non-financial incentives and improved reliability together help boost immunization rate. They suggested immunization provided through incentivized reliable camps are much cost effective than purely improving supply. Johri *et al.*, (2015) in a systematic review and meta-analysis of strategies to increase the demand for childhood vaccination in low and middle income countries find that cash and in kind incentives have a positive effect on the uptake of immunization services.

Description of Intervention

The proposed intervention is based on Banerjee et al, 2010, where as mentioned, immunization camps were established in hard to reach areas of rural Rajasthan. Vaccination was incentivized with the provision of lentils and a hot meal worth Rs 685 in current INR.

There were also promotion efforts by local field workers to let villagers know about the immunization camps.

A complete set of Infant and Childhood immunizations (ICI-package) has been a part of national health strategy since at least the early 1950s and partly sensitized by international agencies such as the World Health Organization, the UNICEF and the World Bank during the 1970s. The national health policy supported and promoted the ICI-package as a part of its public health institutional and infrastructural network to reach children even in rural outback and urban peripheries and slums. The extension services for the ICI-package was anchored on a network of Primary Health Centres and a larger number of Auxiliary Nurse midwives (ANM) Sub-Centers across the nation. However, the health personnel development and deployment for extension work differed extensively across states and more recently large shortages of such personnel have affected the ICI-Package. Since immunizations are also dispensed by the private health sector the role of public health care services has stumbled and deteriorated. A hierarchical list of the public health care institutional system is presented in the following figure.



Source: Authors

Despite this extensive network only 65% of children across the state are fully immunized. Additionally, several districts in Andhra Pradesh lag behind the state average in terms of percentage of full immunization (East Godavari, Sri PottiSriramulu Nellore, Srikakulam and

Vizianagaram). The average rate of immunization in these districts is 55%. This intervention targets these districts where 2.2 lakh children are born every year.

Costs and Benefits

Costs

The first step in calculating the costs is to estimate the number of new children fully vaccinated as a result of the intervention. In Banerjee et al (2010) immunization camps with incentives had 39% rate of complete immunization compared to only 6% in control villages. This implies an almost 700% boost to immunization from the intervention, albeit from low levels. In this study we make the more conservative assumption that the intervention will be able to raise rates of full immunization from 55pp in lagging districts to the state average of 65pp, an increase of 18%. These data are taken from NFHS-4 state reports. This implies an extra 22,285 children immunized in these districts.

We also assume, due to the incentive, 70% of children who would otherwise be vaccinated in the normal health care system such as in schools and health centers will be diverted to the immunization camps. This implies an additional 86,000 children will be vaccinated in the camps. The total number of children passing through the camps in a year is therefore 108,000.

We use variable and fixed cost data provided in Banerjee *et al.* (2010) to estimate the costs of this intervention. Incentives were USD 6.6 in the year of the experiment (2005) and this implies a value of Rs 685 per child in 2017 after adjusting for inflation. The fixed cost per camp per day is Rs 2149 covering all staff, equipment and infrastructure, and each camp vaccinates 11 children on average per day. The cost of vaccination per child (Rs 185) is drawn from Chatterjee *et al.* (2016), and is only applied to new children vaccinated. As in the previous intervention we also account for the cost of caregiver time, assumed to be 2 hours per visit.

The total cost therefore is 10.5 crore per year, Rs 7.4 crore of which is the cost of the incentive and Rs 2.1 crore is the fixed cost of the camp.

Benefits

Immunization is one of the oldest and largest programs of the national and state governments in India. Immunizations are popular and broadly accepted to be useful in reducing many types of sickness amongst the infants and children. The cost of immunization is highly subsidized as a pro-poor government policy and approved by the international multi-national university. They are also found to be highly efficient in terms of benefit-cost ratios (Jamison et al, 2012). To estimate the benefits of interventions we draw upon McGovern and Canning (2015). Utilizing data from 149 Demographic and Health Surveys, from 1985 to 2011 the authors estimate the association between vaccination coverage in a survey cluster and all cause child mortality, including adjustments for potential bias in missing data from children who died before surveys were conducted. They find that moving from 0% coverage to 100% coverage within a cluster reduces all cause child mortality for all children in an area by 24%. The study therefore takes into account not only benefits to the immunized children but potential spillover benefits, including for example, from herd immunity to other children in the area. Applying this rate and assuming a linear relationship between coverage and child mortality, we estimate that a 10pp movement in the lagging districts (from 55pp to 65pp) will lead to a 2.4% reduction in child mortality and morbidity for the 2.2 lakh children born each year. This implies 219 deaths and 5946 YLDs avoided each year from the immunization drive. This is valued at 378 crore per year at 5% discount rate. We also include the value of the incentives, 7.4 crore as a benefit. The benefit cost ratio at the 5% discount rate is 37.

Cash Transfers for Antenatal Services

Background and Evidence

Delivery of maternal health care services remains a challenge for most of the country. While it has been established that antenatal care services are an important component of the health system for controlling maternal mortality and morbidity the uptake of ANC services continues to be poor in most of India. The literature on the efficacy of ANC visits supports the notion that they can prevent some amount of neonatal mortality, though the effects vary between studies. Kuhnt and Vollmer (2017), in a study on antenatal care services and implications for health outcomes of children across 69 low and middle income countries found that having at least one ANC visit, regardless of quality of the service, reduced the probability of neonatal mortality by 1.04 pp and infant mortality by 1.07pp. Having at least four ANC visits and having at least once seen a skilled provider reduced the probability by an

additional 0.56% and 0.42% points, respectively. In the Indian context, where there is a 2.8% risk of neonatal mortality (i.e. 28 per 1000 live births, Niti Ayog, (2013)), ensuring women receive four ANC visits (and assuming most women already receive at least one ANC visit) would lead to a 20% (0.56pp/2.8pp) reduction in neonatal mortality. Darmstadt et al (2005) in a review of efficacy of interventions along the spectrum of maternal and infant care estimate that ANC visits that provide physical examination, tetanus toxoid vaccination and detection and treatment for syphilis and pre-eclampsia can reduce neonatal mortality by 10-20%. In terms of India specific evidence, Singh *et al.*, (2014) studied the association between ANC care and neonatal mortality in India and found that the odds of neonatal mortality were significantly lower in neonates whose mothers had had availed four or more ANC visits (odds ratio 0.69 relative to no ANC visits, 30% reduction in neonatal mortality). Gupta *et al.*, (2015) in the context of EAG states in India, showed that babies whose mothers had had 4-6 ANC visits experienced reduced odds of neonatal mortality (0.73 relative to no ANC visits, 26% reduction in neonatal mortality). A study in Bangladesh (Abir *et al.*, 2017) found that ANC visits, iron and folic acid supplementation along with vaccinations during pregnancy significantly reduced child mortality (odds ratio 0.6, 39% reduction in child mortality). Arunda *et al.*, (2017) examined the effectiveness of ANC services in reducing neonatal mortality in Kenya. They found that the highest odds of neonatal mortality were amongst neonates whose mothers did not attend any ANC visit (adjusted odds ratio 4.0 relative to four ANC visits, 74% reduction in neonatal mortality). Babies whose mothers attended only 1-3 visits experienced higher neonatal mortality odds of 1.8 (44% reduction in neonatal mortality).

Description of Intervention

The intervention seeks the provision of (a maximum of) Rs 2000 for accessing 4 ANC visits during pregnancy. This inducement is designed to foster demand and cover wage losses, opportunity cost and transportation costs in accessing ANC services. This intervention is similar in spirit to the Maternity Benefit Program (MBP) announced in 2016 by the national government. At the time of writing this paper, it had not been scaled up and there were no evaluations available. The MBP provides support for the first child and one ANC visit along with other services such as immunization. It therefore differs from the intervention analyzed in this paper, which includes all children and is only focused on incentivizing 4 ANC visits.

We assume the Rs. 2000 incentive will boost uptake of ANC services from current levels. This is based on similar success of Janani Suraksha Yojana (JSY), a nationwide conditional cash transfer program introduced in 2005 that incentivized women to give birth in health facilities. It is the largest conditional cash transfer program in the world (Lim et al 2010). Powell - Jackson et al (2015) indicates that by 2008, in districts where the program had greater than 50% coverage, women were 7.5pp (19%) more likely to give birth in an institution compared to before the introduction of the program. Other studies echo this broad finding that cash incentives have increased the proportional of institutional births significantly (Randive et al, 2013, Lim et al 2010). The latest round of survey data (NFHS4 data gathered in 2015-2016) shows that across India, institutional births have continued their upward trend and have now risen to almost 80%. In Andhra Pradesh this figure is 92%. While no studies (up to now) have tested to what extent this recent surge is due to the JSY program, it appears likely that incentives have played a large part.

While we can be confident of the direction of the impact, estimating the size of the effect of a conditional cash incentive program on ANC visits, based on the JSY program is not a straightforward process. Effect sizes from studies mentioned above suggest improvements ranging from 19% (Powell - Jackson et al, 2015) to 45% (Lim et al 2010) to 145% (Randive et al 2013). The latest NFHS4 data suggest even larger effect sizes are possible, over time.

In the case of Andhra Pradesh, the proportion of women receiving 4 ANC visit is already high at 76% (the Indian average is 51.2%, NFHS4). We assume that the incentive will bring the rate of 4 ANC visits to 92%. This is in line with the recent data on incentivized institutional births (92%) as well as (coincidentally) the approximate end line if one were to apply the effect from Powell - Jackson et al of 19%.

Costs and Benefits

Costs

As stated above, 76% of women make the recommended quota of 4 ANC visits during pregnancy. For the remaining women, the average number of visits is 1.75. Given 8.2 lakh new births per year, the intervention will therefore induce 1.3 lakh women to undertake 2.9 lakh new visits.

The costs of the intervention represent the incentive (Rs. 2000) for 76% of all pregnant women who would have gone to 4 ANC visits without the incentive, and for the new women making 4 ANC visits (16% of all pregnant women). Given 8.2 lakh new births per year, this cost comes to 151 crore.

Shankar Prinja *et al.*, (2016) estimate that the government cost to supply one ANC visit is Rs 166 (average of Rs 171 for PHCs and Rs 162 for CHCs). NSS 71st round data indicate that additional private costs (which includes doctors' fees, cost of medicine, diagnostics tests, transportation etc.) is Rs. 205 for Andhra Pradesh. Lastly, we incorporate a cost for the women's time, assuming, like in the case of breastfeeding promotion that a visit takes 2 hours and the average daily wage in AP is 286. We apply these unit costs to the number of new ANC visits made as a result of the program. The total marginal health system and private costs are 12 crore. The total cost of the intervention is therefore, 163 crore.

Benefits

The preceding literature review suggests that 25% reduction in neonatal deaths is a reasonable estimate of the impact in the Indian context from increased ANC visits. Applied to Andhra Pradesh, where neonatal mortality is 25 per 1000 deaths, this would result in 804 fewer neonatal deaths and 6062 fewer YLDs per year. The health benefit is valued at 800 crore and with the incentive benefit of 151 crore, the total benefit is therefore 950 crore (5% discount). The benefit cost ratio is 6.

Conclusion and Quality of Evidence

The preceding analysis suggests that immunizations provide the highest benefit-to-cost ratio while breastfeeding promotion yields the largest net benefits. Summary results are presented below at discount rates of 3%, 5% and 8%.

Intervention	Discount Rate	Benefit	Cost	BCR	Quality of Evidence
Mass media promotion and intensive counselling of breastfeeding	3%	7,905	749	11	Strong
	5%	5,757	749	8	
	8%	4,234	749	6	
Promotion, incentivization and supply of immunization in lagging districts	3%	463	10	44	Strong
	5%	385	10	37	
	8%	329	10	31	
Conditional cash transfer for ANC visits	3%	1,239	163	8	Strong
	5%	950	163	6	
	8%	746	163	5	

It is important to note while all interventions do generate great benefits, they may produce many types of externalities not accounted for in this analysis and estimation of benefit-cost ratios. For example, enhanced investments in MCH may also improve health and survival of pregnant and lactating mothers thus reducing maternal mortality. Further, there are many synergies and mutually beneficial effects of all these three inventions can generate. Such synergistic benefits can be very high and developmental in nature.

We assess the quality of evidence for all interventions as “strong”. The basis for each intervention comes from either a randomized controlled trial (Menon et al, 2015, Banerjee et al 2010) or a high quality observational study using survey data (Powell - Jackson et al 2015). All of these are from the Indian context, except in the case of Menon et al (2015), for breastfeeding promotion. However we are confident in the external validity of the intervention due to the fact that meta-analyses (Sinha et al, 2015) and experiences from other countries (Quinn et al, 2001) suggest that breastfeeding promotion via mass media has significant and large effects on breastfeeding practice in developing countries.

The effects of each intervention in terms of health impacts are fully or partially based on meta-analyses (Sankar et al, 2015), or analyses of thousands of observations from scores of demographic and health surveys across the developing world (McGovern and Canning, 2015, Kuhnt and Vollmer, 2017). This provides confidence that the effects of increased breastfeeding, vaccination and ANC visits do indeed lead to the benefits assessed in this paper.

Perhaps the intervention with the greatest uncertainty is the conditional cash transfer for ANC visits. The JSY program was motivated by evidence that institutional births lead to lower levels of maternal and child mortality. However, careful analysis suggests that JSY has not lead to a reduction in either metric, despite the large increase in institutional births (Powell - Jackson et al 2015). This is most likely due to the poor quality of infrastructure and equipment in birthing facilities. To the extent that health system shortfalls also affect the provision of ANC services it is possible that the benefits assessed here may not materialize. That said, the services provided during ANC services that reduce mortality risk (e.g. tetanus toxoid, provision of iron-folic acid) are not as complex or costly as the services that reduce mortality risk during intrapartum (e.g. caesarean sections, incubators). For this reason we retain the assessment quality as strong.

Appendix: 1

Empirical Evidence from a Recent all India survey

The authors consulted the unit level records data for a large nationally representative sample survey to understand the dynamics of relationships and relative importance of the variables and factors that are in play in the domain of Maternal and Child Health. The regressions were undertaken using Infant and Child Mortality as the dependent variable.

Although India is unique and has a long history of generating a lot of data in various areas of public health, MCH, family planning and health care management; most data flows out of the service statistics of the government departments and from a few specialized surveys. Data that can be analysis in the multi-variate context are rare. One exception has been the exclusive Human Development Surveys of the NCAER conducted regularly since 1992 (see Shariff 1999, Desai and Shariff 2004). In the following we have used data from a recent NCAER survey to find out the relative importance of many independent variables through Logit Regression models.

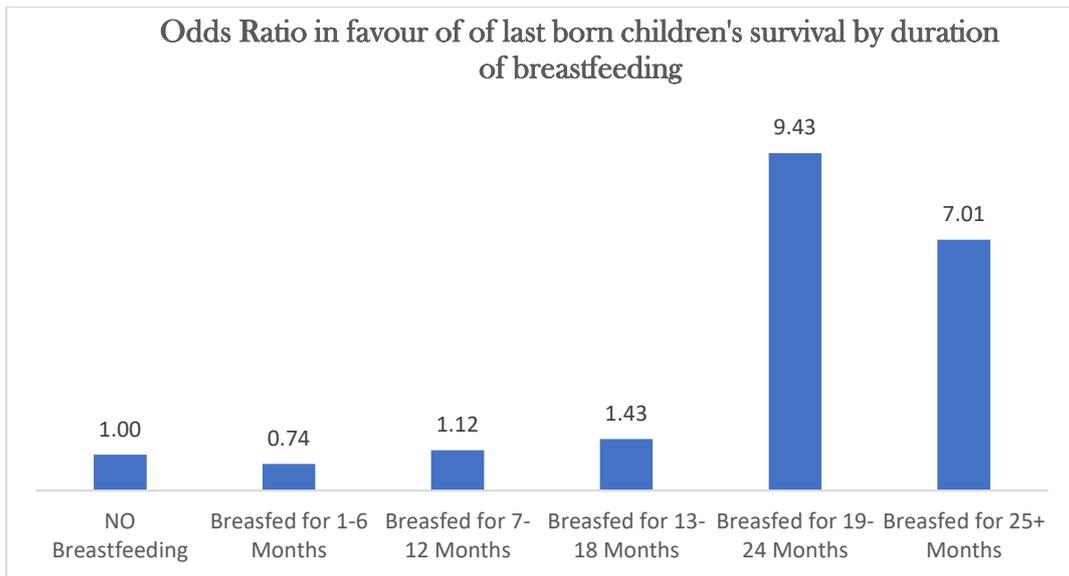
Logit regression on last born child's being alive

(Household Data: India Human Development Survey 2011-12, NCAER)

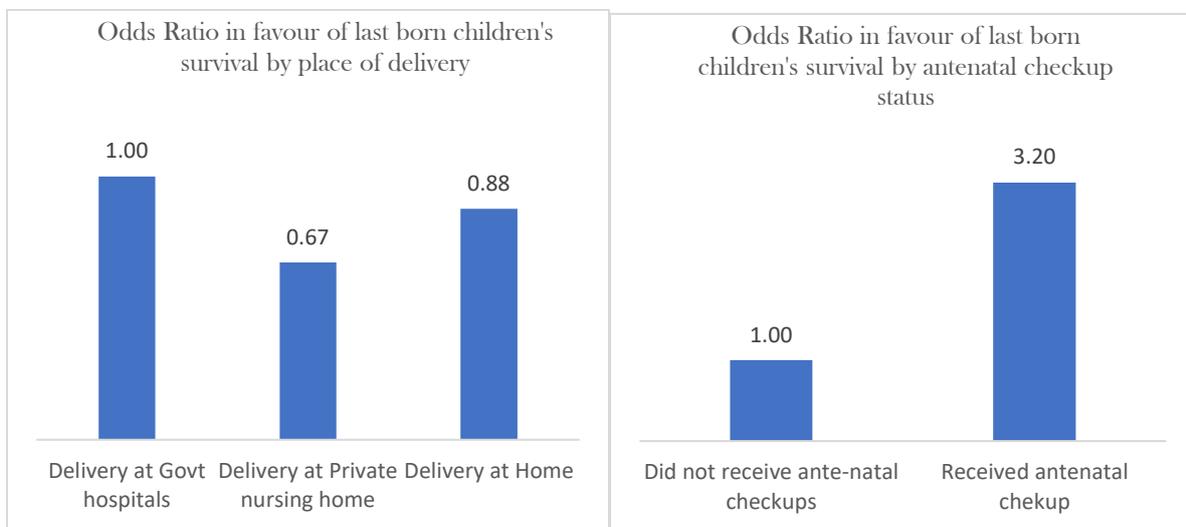
Dependent variable: Current survival of last born child

Independent variables:

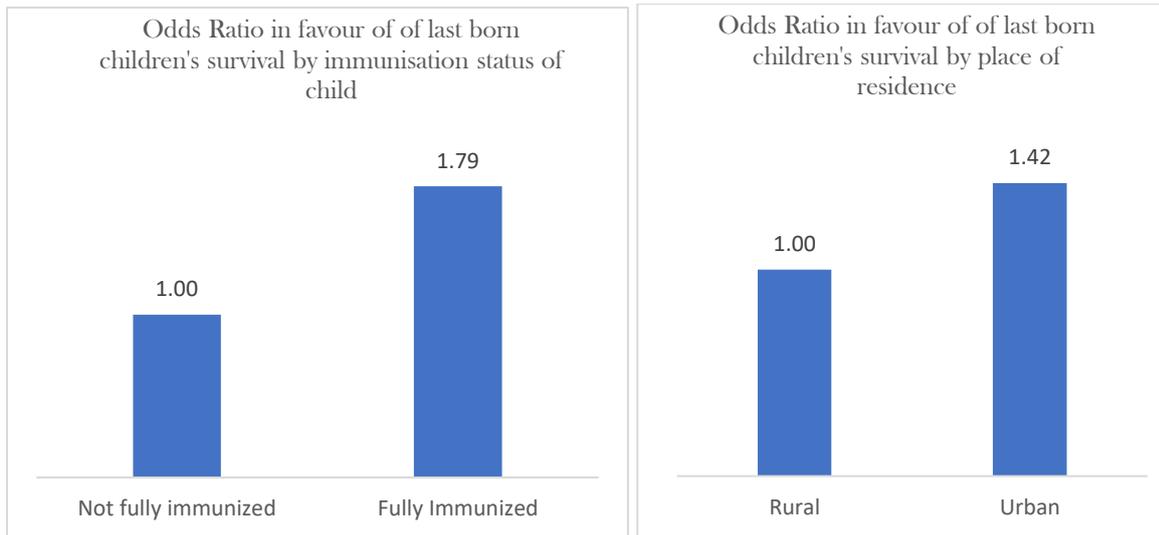
- Number of months for which child was breastfed
- Whether mother got antenatal checkup
- Place of delivery
- Rural/Urban residence
- Mother's years of schooling/education



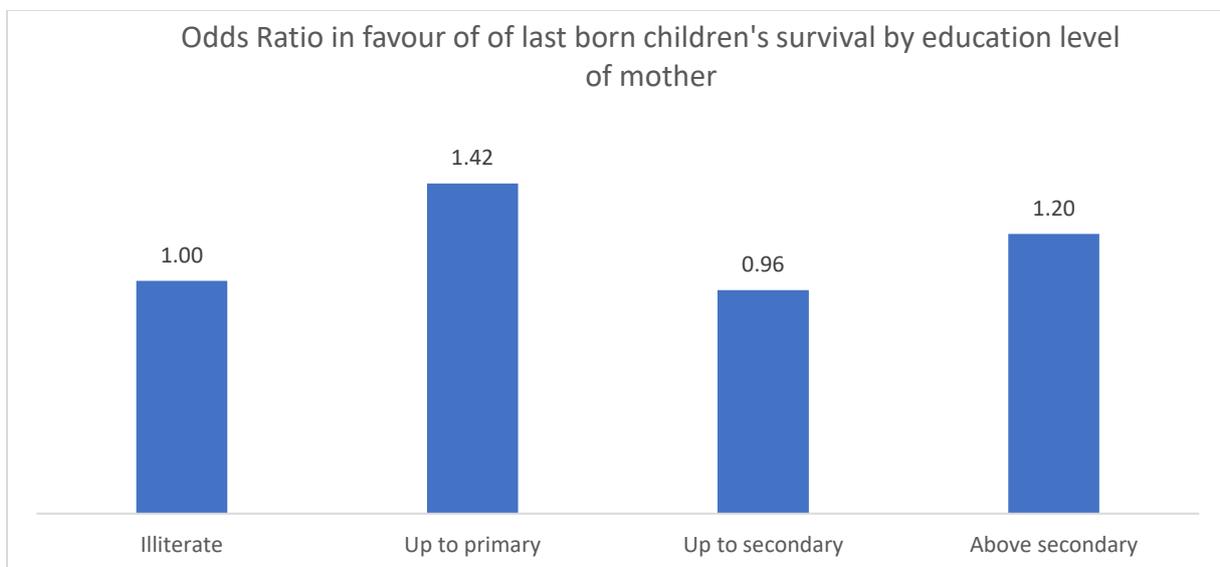
Source: Authors' estimation using IHDS-II data



Source: Authors' estimation using IHDS-II data



Source: Authors' estimation using IHDS-II data



Source: Authors' estimation using IHDS-II data

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As a new state, Andhra Pradesh faces a bright future, but it is still experiencing many acute social and economic development challenges. It has made great strides in creating a positive environment for business, and was recently ranked 2nd in India for ease of doing business. Yet, progress needs to be much faster if it is to achieve its ambitions of becoming the leading state in India in terms of social development and economic growth. With limited resources and time, it is crucial that focus is informed by what will do the most good for each rupee spent. The Andhra Pradesh Priorities project as part of the larger India Consensus – a partnership between Tata Trusts and the Copenhagen Consensus Center, will work with stakeholders across the state to identify, analyze, rank and disseminate the best solutions for the state. We will engage people and institutions from all parts of society, through newspapers, radio and TV, along with NGOs, decision makers, sector experts and businesses to propose the most relevant solutions to these challenges. We will commission some of the best economists in India, Andhra Pradesh, and the world to calculate the social, environmental and economic costs and benefits of these proposals



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