

# The Effect of A Demand Side Financing Program on the Continuum of Maternal and Child Health Care in India

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## Research article

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# Abstract

**Background** The Indian Government launched a demand-side financing program, 'Janani Suraksha Yojana' (JSY) in 2005 with the aim of reducing maternal and neonatal mortality through increased access to institutional delivery care service. This paper analyses the effects of the JSY on the uptake of maternal and child health (MNCH) care services intending to understand the overall impact of the program on the continuum of care.

**Methods** Using the 2013-14 round of the District-level Household Survey (DLHS) surveyed in high performing states, the average treatment effect on the treated (ATT) was estimated by using the Propensity Score Matching (PSM). Results are reported regarding both ATTs and deviations from the theoretical continuum of care line, which represents 100% uptake, i.e., all women availing all the MNCH services.

**Results** Overall, JSY effects on MNCH components ranged between 0.7% and 12%. As expected, the highest impact of the JSY was on institutional delivery (ATT: 0.12; 95% CI: 0.104-0.131) and the lowest for breastfeeding more than six months (ATT: 0.007; 95% CI: -0.014-0.027). Deviation from the complete continuum of care line ranged from 2.3% to 80.9%. The highest deviation was for three or more Tetanus Toxoid (100%-19.1%=80.9%) injections and the lowest for Polio given at any time (100%-97.7%=2.3%).

**Conclusions** The program had high effects on those MNCH care services, the uptakes of which were already high without the program (low deviations from the continuum of care line), and the program had low effects on those MNCH care services, which had low uptakes in the absence of the program (high deviations from the continuum of care line). The program should also incentivize the utilization of those MNCH care services, which have low uptakes in the absence of the program.

## Significance

Impact of Janani Suraksha Yojana (JSY), one of the largest demand-side financing programme in the world, on individual components of maternal and child health (MNCH) is already known. But there is no research on the impact of JSY on all the MNCH components as continuum. This research provides new knowledge on the impact of JSY on all components of MNCH.

## Introduction

India has made significant progress in maternal and child health (MNCH) indicators in the last two decades. Maternal and neonatal death rates are still higher than that of economies of similar magnitude. For example, the maternal mortality ratio (per 100,000 live births) was 174 in 2015, which was higher than corresponding figures for comparable developing countries in Asia, such as Indonesia (126), and Malaysia (79) (WHO, 2015). Access to and/or demand for maternal and child health services were identified as barriers to progress in maternal and child health in many developing countries, including India. To overcome these demand-side barriers, following multiple countries (Anwar et al. 2008; Behrman and Knowles 1998; Bhatia et al. 2006; Bhatia and Gorter 2007; Van de Poel et al. 2014), the Government of India launched a Demand Side Financing (DSF) program known as 'Janani Suraksha Yojana' (JSY).

JSY is one of the largest DSF programs in the world. It was launched in April 2005 by the prime minister of India. The key objective of the JSY is reducing maternal and neonatal mortality by promoting institutional delivery in public or accredited private healthcare institutions. The JSY initially targeted poorer women in selected poorer states. However, JSY was extended to all states in 2007. As of January 2017, all pregnant women are eligible for JSY in 10 low performing states (LPS) where the rates of institutional delivery were below 25%. These are: Uttar Pradesh, Uttaranchal, Bihar, Jharkhand, Madhya Pradesh, Chhattisgarh, Assam, Rajasthan, Orissa, and Jammu and Kashmir. All other states were high performing states (HPS), those with more than 25% institutional delivery rates. Only the poor and marginal women, such as scheduled caste and tribal women, are eligible for the program in HPS.

The overall eligibility criteria for JSY in LPS and HPS are listed in Table 1. However, in HPS, some of the criteria were amended in 2013 by removing restrictions regarding age and the number of children. As earlier (in Table 1), JSY was only open to women living below the poverty line, scheduled caste, or scheduled tribe categories. But the earlier version excluded those women who were 19 years and less and had more than the second birth. This amendment was based on the review that found women aged below 19 years and with higher numbers of children were at higher risk of maternal mortality and their children experienced higher rates of neonatal mortality. Although these restrictions were amended in May 2013, we are unable to report when they were implemented in various states. However, these changes have no impact on the present study, as our data comes from the survey happened in 2013–2014 and the times of the last births of women used in this study fall within the period from 2008 to just before the survey (that means the survey included those women who already gave their last births). So, this study uses the eligibility criteria mentioned in Table 1.

JSY is implemented through the public healthcare system. Accredited social health activist (ASHA) and grassroots level health volunteers work as an intermediary between the health system and pregnant women to implement the JSY. In both LPS and HPS, the roles of the ASHA associated with the JSY are as follows (Yojana 2006): (1) to identify the eligible pregnant woman for JSY and to report or facilitate registration for Antenatal Care (ANC); (2) to assist the pregnant woman in obtaining the necessary certificates of the eligibility for JSY; (3) to provide and/or help the pregnant woman in receiving at least three ANC check-ups, including tetanus injections and Iron Folic Acid tablets; (4) to identify a functional Government healthcare centre or an accredited private health institution for referral and delivery; (5) to counsel for institutional delivery; (6) to escort the beneficiary woman to the pre-determined health centre and stay with her until discharged; (7) to arrange to immunize the new born until the age of 14 weeks; (8) to inform of the birth or death of the child or mother to the auxiliary nurse and midwife; (9) to arrange a postnatal visit within 7 days of delivery to track mother's health after delivery and facilitate in obtaining care, wherever necessary; (10) to counsel for initiation of breastfeeding of the new-born within one-hour of delivery and its continuance until 3–6 months and promote family planning. ASHA receive financial incentives for undertaking the above activities under the JSY.

When the eligible pregnant woman visits a public health facility for the first time to register her entitled benefits/services – three antenatal care services including iron-folic acid and tetanus injection, institutional delivery and one postnatal care service for both mother and the new born, she receives her total entitled cash as payee cheque from that facility. If she goes first time to an accredited private health facility for those entitled benefits' registrations, that facility gives her the third-fourth of her entitled cash at the time of that visit and the rest at the time of her discharge after delivery. Without those services' registrations, an eligible woman will not

receive her entitled cash at all. The ASHA gets her entitled money also from the facility where the JSY recipient woman gave her birth but only at the time of her discharge after delivery. As JSY directly works to increase the uptake of the above registered services, these are called intended outcomes. The program may have effects not only on intended outcomes but also on unintended outcomes such as immunization and birth rate because of a spill over effect. There are several studies (Carvalho et al. 2014; Das et al. 2011; Gopalan and Durairaj 2012; Gupta et al. 2011; Gupta et al. 2012; Khan et al. 2010; Lim et al. 2010; Powell-Jackson et al. 2015; Modugu et al. 2012), which show the effects of JSY on both intended and unintended outcomes.. However, these studies were limited to discussing the effects of JSY on some specific (intended or/and unintended) MNCH care components/services. Such treatment effect analyses are not able to provide sufficiently a broad picture regarding pathways towards reducing maternal and child mortality rates (Angrist and Pischke 2008). For this, a method that provides information about how the program is performing with regard to all (possible intended and unintended) service components is needed. The proposed approach is consistent with the current understanding that gains in reproductive, maternal, newborn, child and adolescent health can best be realised by ensuring services across the continuum of care, rather than concentrating on one element or some elements and the neglect of others.

The hypothetical/theoretical Fig. (1) illustrates the concept of the continuum of care. The horizontal axis of the figure shows four hypothetical MNCH care services, such as MNCH1-MNCH4. For the time being, we consider that these are all possible intended and unintended service components under the continuum of care required to reduce maternal and child mortality. The vertical axis of the figure shows the utilization rates (or uptakes) of those four service components with JSY and without JSY. That axis also shows the continuum of care line (parallel to the vertical line) at where the utilization rates of those service components are 100% (e.g., 1). If all mothers in an area or a country received all the components in the figure, the continuum of care line would have been obtained. Any deviation from the straight (e.g., continuum of care) line to the level of uptake of a service/component (indicated in red with JSY and green without JSY) indicates a gap in the uptake. The gap could depend on the JSY intervention or lack of it. It is hypothesized here that the JSY intervention will increase the uptake of a service and decrease the gap. The objective of this paper is to measure gaps between uptakes with and without JSY and also gaps between the continuum of care line and uptakes without JSY. These measures together will demonstrate the effect of the JSY on the MNCH continuum of care.

## Methods

### Data

The study used wave 4 (2013-14) of the Indian District Level Household Survey (DLHS-4). DLHS is the most suitable for the present study, and earlier waves of DLHS have already been widely considered for JSY evaluation (Carvalho et al. 2014; Gopalan and Durairaj 2012; Gupta et al. 2012; Lim et al. 2010; Powell-Jackson et al. 2015; Nandi and Laxminarayan 2016) and the data refer to periods when the JSY was not in full operation. Unlike earlier DLHS, where the survey covered all major states, wave 4 was done in 18 high performing states (Andhra Pradesh, Arunachal Pradesh, Goa, Haryana, Himachal Pradesh, Karnataka, Kerala, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Punjab, Sikkim, Tamil Nadu, Telangana, Tripura, West Bengal) and three high performing Union Territories (Andaman and Nicobar Islands, Chandigarh, and Pondicherry) where the institutional delivery rates are more than 25% (MoHFW 2013). Data are not available for

other states and Union Territories. However, these 21 high performing states and Union Territories contain around two-thirds of the Indian population. In this study, we use data from all of these 21 high performing states and Union Territories.

The DLHS-4 adopted a multi-stage stratified systematic sampling design. Data were collected through interviews using bilingual questionnaires. The survey covered 378,487 households. In this study we used data from 73,073 mothers in the age group 15–49 years who had provided information about their pregnancies since 2008. In this study only mothers who have responded to all the continuum of care variables are included. As JSY was implemented in 2007 in the HPS, all pregnancies captured by DLHS-4 fall within the time frame of the program implementation.

## Propensity score matching

Women are selected for JSY based on eligibility criteria, i.e. observed characteristics. In such cases, Propensity Score Matching (PSM) is a widely used method, which can turn data so that random distribution of treatment and control groups, under unconfoundedness and overlapping assumptions, can be availed when there was actually no randomization (Angrist and Pischke 2008). However, for unbiased results, matching variables should be chosen carefully so that the problem of incomplete (inadequate matching variables) and inexact (unrelated matching variables) matching is minimal. We have chosen matching variables based on eligibility criteria chosen by the JSY and self-selection criteria of women. We assume that there is no self-selection bias or endogeneity bias because, after matching, unobserved factors also become random between treatment and control groups along with observed factors.

In the online appendix, we have described which matching variables are used to estimate propensity score. We have also checked whether two crucial assumptions, unconfoundedness and overlap, are satisfied or not. Which algorithm is used is also mentioned in the online appendix. Overall, we have followed mostly the guidelines of Yao et al. (2017) to explain the propensity score method briefly.

The list of outcome variables is shown in Table 4. All of them are the continuum of care components, which are the dummy variables. They have a common sample size, which is 29,858. As we mentioned earlier, the sample size drastically falls from around 70,000 women to 29,858 women, because many women did not respond about child immunizations because probably their children did not reach the ages of immunizations and therefore did not take immunizations. In other words, mostly huge numbers of missing values in immunizations left the common sample as low. However, we have to focus on these common women, because, for the continuum of care analysis, we need to know how much a group of women utilized all continuum of care services. In other words, we need to understand how the same women behave differently in different components of the continuum of care. If we take different samples for different components of the continuum of care, the gaps between the continuum of care line and the actual uptakes of those care components will not be comparable.

## Results

Table 4 provides ATTs with 95% confidence intervals and associated probabilities. It also provides means of MNCH variables in the treatment group (JSY) and control group. ATT is the difference between the means of

MNCH services received by the treatment group and the service taken by the same group if they were not treated i.e. if they were not JSY recipients (Rubin 1974; Rubin and John 2001). ATT is obtained from the matched sample obtained through PSM. The means of MNCH service indicators of the treated group under both unmatched and matched conditions are the same. In the controls column, the means of MNCH services in the unmatched and matched categories are different. This is because, in the unmatched sample, we estimated means of MNCH indicators of the non-recipients (control group) of the JSY. In the matched sample, we calculated the means of MNCH services of JSY recipients (treatment group) as if they were non-JSY recipients. This is done by imputing MNCH indicators of the treated group after finding the closest matches from the untreated/control group. So, ATT is the difference between the mean of actual values of a MNCH service of the treatment group and mean of the imputed values of that service of the same group, but those imputed values are taken from the control group through matching. The means of both actual and imputed values of MNCH indicators of the treatment group are provided in Figs. 2(a) to 2(e). In the graphs, dotted lines indicate actual values of MNCH variables of treated group and solid lines imputed values of those variables of the same group. The deviations of dotted and solid lines from the full continuation of care (MNCH) line are represented in the vertical axis.

## ANC services uptake

Figure 2(a) and Table 4 (Section-1) show the effect of JSY on the ANC services. Among the ANC services, JSY had the highest effect on the uptake of Iron Folic Acid (IFA), 9% ( $0.789 - 0.700 = 0.089$ ). Without the JSY program the uptake of IFA would be around 70%. The second highest effect of JSY was on women receiving at least one Tetanus Toxoid (TT) injection, 8% ( $0.924 - 0.840 = 0.084$ ). However, the effect of JSY on at least 3 TT injection doses was only 3% ( $0.19 - 0.164 = 0.026$ ). Thus, even with JSY intervention the uptake of at least 3 doses of TT injections was only 19%. The other ANC components that had similar impact were registering pregnancy, 8% ( $0.959 - 0.877 = 0.082$ ); and at least 3 ANC visits, 8% ( $0.780 - 0.700 = 0.080$ ). Interestingly, the impact of JSY on the uptake of at least one ANC check-up was only 6% ( $0.952 - 0.888 = 0.064$ ). This may be due to existing high levels of at least one ANC uptake. Measuring weight and height are part of the monitoring of pregnancy progress, and, in this study, the JSY effect on measuring these markers were 8% ( $0.874 - 0.794 = 0.080$ ) and 5% ( $0.588 - 0.538 = 0.049$ ), respectively. Checking blood pressure is a vital component of ANC consultation to identify women with potential risk of pre-eclampsia and the JSY had about 7% effect ( $0.802 - 0.736 = 0.066$ ). Blood tests are carried out as part of ANC consultations and the effect of JSY on blood tests for haemoglobin and blood group identification were 7% each ( $0.733 - 0.666 = 0.068$ ) and ( $0.675 - 0.605 = 0.070$ ), respectively. During ANC visits, urine tests are done, and JSY recipients had about 6% ( $0.773 - 0.710 = 0.063$ ) increased uptake compared to the non-JSY group. During ANC women are to be informed about delivery date. The JSY effect was about 6% ( $0.600 - 0.548 = 0.058$ ). Examining abdomen and breasts are also part of ANC check-up. In this study the effect of JSY for abdominal and breast examination was 5% ( $0.575 - 0.527 = 0.048$ ) and 2% ( $0.392 - 0.374 = 0.018$ ), respectively. The effect of the JSY on the uptake of sonogram/ultrasound was about 4% ( $0.654 - 0.620 = 0.034$ ). Overall the effect of the JSY program on the ANC services uptake was between 2–8%. It is clear from the graph that the JSY had very little effect on changing the pattern of uptake of 16 ANC indicators analysed in this section. MNCH indicators that had higher deviation from the continuum of care line,  $\geq 3$  TT for example, largely remained unchanged with the JSY intervention.

## ANC Advice

Figure 2(b) and Table 4 (Sect. 2) presents JSY program effect on the advice given to women for a number of pre-natal, natal and post-natal care. JSY had the highest effect on giving breastfeeding advice, 10% (0.607 – 0.549); followed by institutional delivery, 10% (0.374 – 0.277 = 0.097); cleanliness during delivery time, 6% (0.524 – 0.459); family planning advice for spacing, 6% (0.460 – 0.404 = 0.056); nutrition, 5% (0.477 – 0.427); family planning advice for terminal methods, 4% (0.400-0.359 = 0.041). The highest deviation from the continuum of care line was advice on family planning for limiting the number of children (54%) and the lowest for advice on institutional delivery (37.4%).

## **Institutional delivery, postnatal care and advice for the mother**

Figure 2(c) and Table 4 (Sect. 3) presents the effect of the JSY on institutional delivery, postnatal care and advice for the mother. Under this analysis 7 PNC indicators are analysed. Among the PNC indicators considered the JSY had the highest effect on institutional delivery 12% (0.953 – 0.836 = 0.118). Without the JSY, institutional delivery would be 84% in the study population compared to 95% with JSY. The next highest effect of the JSY was on check-up within 48 hrs of delivery, it had 11% effect (0.769 – 0.622 = 0.107) followed by check-up after birth in the facility at 10% (0.769 – 0.670 = 0.099); abdomen examined at 6% (0.492 – 0.427 = 0.065); advice on breastfeeding at 7% (0.498-0.426-0.072); advice on baby care at 8% (0.472 – 0.396 = 0.076) and advice on family planning at 8% (0.363 – 0.286 = 0.078). The lowest deviation from the continuum of care line is institutional delivery (4.7%) and the highest in advice on family planning (37.4%).

## **Postnatal care for children**

The JSY effect on the postnatal care for children are given in Fig. 2(d) and Table 4 (Sect. 4). Among the measures taken in this section, the highest impact of JSY was on weight taken at birth, the effect was 10% (0.929 – 0.833 = 0.096). The effect of JSY on check-up after delivery was 6% (85.9 – 79.9 = 0.060). It appears that not all children whose weight was taken at birth had a check-up after birth. Breastfeeding for more than 6 months was not significantly different between the treated and control group, suggesting no effect of JSY on breastfeeding (0.466 – 0.459 = 0.007). The JSY had around a 5% effect (0.573 – 0.522 = 0.052) on increasing women's knowledge about managing diarrhoea for the new-born. Deviation from the line of continuum of care to the line of the treated group varied between 2.3 to 25.7%. The highest deviation was women's knowledge about phenomena (69.5%) and the lowest was for weight taken at birth (7.1%).

## **Immunisation and Vitamin A for children**

This section examines the effect of JSY on immunisation, although JSY had no mandate to increase immunisation. It considers 6 immunisations and the results are given in Fig. 2(e) and Table 4 (Sect. 5). Overall, immunisation coverage in the study population without the JSY ranged between 68%-98%. Therefore, the JSY had a relatively lesser scope to further increase uptake of some of the immunisation, particularly those close to 100% coverage. The JSY had 6% impact on the uptake of Vitamin A among the children (0.743 – 0.686 = 0.056) followed by Polio within the first two weeks of birth with 4.3% (0.813 – 0.769 = 0.043). However, the effect of JSY on Polio uptake at any time was only 1.8% (0.977 – 0.959 = 0.018). The effect of JSY on Hepatitis-B was 4% (0.878 – 0.842 = 0.036) and for DPT 3.8% (0.911 – 0.873 = 0.038); for Measles 3.6% (0.878 – 0.842 = 0.036) and for BCG 2.2% (0.976 – 0.954 = 0.022). Deviation from the line of continuum of care to the line of the treated (JSY) group varied between 2.3 to 25.7%. The highest deviation was found for Vitamin A (25.7%) and the lowest for Polio (2.3%) and BCG (2.4%).

## Discussion

This is the first study published that examined the effect of JSY on the continuum of care for maternal and child health indicators. An important aspect of this study was its use of the most recent data from the fourth wave of the District Level Household Survey (DLHS-4) carried out during 2013-14 from 18 High Performing States (HPS) and 3 Union Territories in India. Previous research used earlier waves of DLHS or have limited the analysis to individual components of MNCH indicators. Most of those studies have done analysis on either a mixture of LPSs and HPSs (Carvalho et al. 2014; Lim et al. 2010), or LPSs and HPSs separately (Lim et al. 2010; Modugu et al. 2012), or only LPSs (Gopalan and Durairaj 2012; Gupta et al. 2011; Gupta et al. 2012; Khan et al. 2010). The main focus of this paper is to estimate the effect of JSY on the uptake of 45 MNCH indicators. It further examined deviation from the full continuum of care line, where all women use all the MNCH services, to what has been achieved through JSY and estimated the gap to achieve 100% uptake, and explored whether the program could make substantial changes in the pattern of uptake of MNCH services.

Overall, the JSY effect on MNCH indicators varied between 1% and 12%. No woman in the study had taken all the 45 MNCH services and no MNCH service was taken by all the women. It is important to note that not all elements of MNCH are equally important for maternal and child survival, but they all are important to ensure longer-term health and well-being of the mother and child. Therefore, it is necessary to utilise all the MNCH services recommended for mother and child health, which is still at risk in developing countries, including India.

Increasing institutional delivery uptake has been the key focus of JSY. In this study the effect of JSY is about 12%. That means an additional 12% of women have taken institutional delivery due to JSY, and this leads to about 95% women availing institutional delivery in the HPS state leaving a remaining 5% to achieve 100% institutional delivery. This is higher than the effect shown in an earlier study carried out in HPS using previous rounds of DLHS (Lim et al. 2010). Studies have also shown that the effect of JSY on the low performing states (LPS), as expected, was much higher. In the HPS, clearly the JSY has been successful in accomplishing its mandate to increase institutional delivery. However, the fact that JSY did not increase the uptake of MNCH indicators uniformly across the MNCH services suggests that the spill over effect of JSY was limited, particularly to those services for which uptake has been very low. Some women have taken institutional delivery without being registered for pregnancy or having access to ANC further suggest some leakage of JSY services. It appears that the focus of JSY on institutional delivery in some cases tends to disregard with ANC services. An increased attention towards pregnancy registration and ANC as the pathway to institutional delivery may be emphasised in the JSY to achieve a continuum of care for MNCH.

Iron Deficiency Anaemia (IDA) is high in India. Treating IDA is vital for better maternal and child health outcomes and (Peña-Rosas et al. 2015). Iron Folic Acid (IFA) is provided to all pregnant women free of cost through the public healthcare service providers, particularly through ASHA, and is one of the activities to be undertaken as part of the JSY. JSY's effect on the uptake of IFA was about 9% and there is a further 21% increase required to reach 100%. A related issue is blood tests carried out for haemoglobin as part of ANC, which is 73% with JSY. Thus, over 20% of pregnant women do not receive IFA or blood test for haemoglobin despite JSY and this calls for a need to re-examine JSY priorities.

Generally, provision of advice on maternal and child health such as advice on family planning, nutrition, diarrhoea, breastfeeding, pneumonia is lower than other more clinically oriented services; such as ANC, delivery,



or immunisation. The spill over effect of JSY on advice on various MNCH indicators was limited. As clinically oriented MNCH service uptake is increasing in the HPS, JSY may reorganize to include MNCH indicators that reflect maternal and child health beyond the pre and postnatal period.

In general, uptake of immunizations for mother and children are high. However, dispensing polio within the first two weeks, Vitamin A for children, and three or more doses of Tetanus Toxoid for pregnant women were relatively lower compared to other immunisations.

## Conclusion

JSY is an effective intervention to increase institutional deliveries in the HPS of India. As many of the MNCH indicators are performing better, it is now time for the JSY to redesign its key objectives to include indicators that are performing poorly. The program may consider staged conditional cash transfer to cover the entire continuum of care spectrum.

Using PSM has possible self-selection/endogeneity/simultaneity bias. The participation in JSY can be affected by unobserved factors along with observed factors. There can be some criteria of the inclusion of a woman into JSY which are unofficially determined by the program administrators. These can be personal relationships between a woman or her family, ASHA worker, geographical location of a woman, and political affiliation of a woman's family. These types of variables are absent in the data. There can be some other potential unobserved factors, which are self-selection criteria of women. These include social restrictions, such as husband's disallowance to participate in JSY and reliability on traditional health workers. If unobserved factors affect the JSY participation, the PSM method will give biased results of treatment effects. However, we assumed that along with observed factors, unobserved factors will also be balanced between treatment and control groups. If the assumptions are true (which cannot be known), there will be no biases due to unobserved factors.

DLHS data is very rich. However, there are some limitations in data too. There are multiple missing values in immunization variables. The main reason being many babies had not yet reached the age of needing immunization at the time of the survey. The surveyors do not, therefore, have any information about them. If we drop immunization variables from the outcome/care variable list, the sample size increases to more than 20,000. To gain more observations we have dropped immunizations from our analysis, as the main focus of the study is the continuum of care, which requires data from pregnancy registration to immunization. However, after dropping immunizations we have compared the results of other services, and found that results remain very close to those of the previous sample with immunizations. The other limitation of data is that DLHS-4 was not surveyed in LPSs where the program is universal.

## Abbreviations

**ANC:** Antenatal Care

**ASHA:** Accredited Social Health Activist

**ATT:** Average Treatment Effect on the Treated

**BCG:** Bacille Calmette Guerin

**DLHS:** District-level Household Survey

**DPT:** Diphtheria, Pertussis (whooping cough), and Tetanus

**FS:** Full Sample

**HPS:** High Performing States

**IDA:** Iron Deficiency Anaemia

**IFA:** Iron Folic Acid

**JSY:** Janani Suraksha Yojana

**LPS:** Low Performing States

**MNCH:** Maternal and Child Health

**PNC:** Postnatal Care

**PSM:** Propensity Score Matching

**RS:** Reduced Sample

**TT:** Tetanus Toxoid

**WHO:** World Health Organization

## Declarations

### Availability of Data and Materials

Both the dataset used in this study and the do file, where data were analyzed, are available from the corresponding author upon request.

### Competing interests

Authors have no competing interest.

### Authors' contributions

The main idea of the research came from Saseendran Pallikadavath, and then Saseendran Pallikadavath, Ngianga Kandala, and Mohammad Mahbubur Rahman planned the research and developed the protocol. Mohammad Mahbubur Rahman analyzed data, estimated results, and wrote the first draft of the report. William Stones and Sumit Mazumdar gave policy-related inputs for the article. All authors critically reviewed the report and approved the final version.

## References

1. Ahmed S, Khan MM. 2011. Is demand-side financing equity enhancing? Lessons from a maternal health voucher scheme in Bangladesh. *Social science & medicine* 72(10): 1704–1710.
2. Angrist JD, Pischke JS. 2008. *Mostly harmless econometrics: An empiricist's companion*. Princeton university press.
3. Anwar I, Sami M, Akhtar N et al. 2008. Inequity in maternal health-care services: evidence from home-based skilled-birth-attendant programs in Bangladesh. *Bulletin of the World Health Organization* 86(4): 252–259.
4. Behrman JR, Knowles JC. 1998. Population and reproductive health: An economic framework for policy evaluation. *Population and development review* 697–737.
5. Bhatia M, Yesudian C, Gorter A, Thankappan K. 2006. Demand side financing for reproductive and child health services in India. *Economic and Political Weekly* 279–284.
6. Bhatia M, Gorter A. 2007. Improving access to reproductive and child health services in developing countries: are competitive voucher schemes an option? *Journal of international development* 19(7): 975–981.
7. Carvalho N, Thacker N, Gupta SS, Salomon JA. 2014. More evidence on the impact of India's conditional cash transfer program, Janani Suraksha Yojana: quasi-experimental evaluation of the effects on childhood immunization and other reproductive and child health outcomes. *PloS one* 9(10): e109311.
8. Crump RK, Hotz VJ, Imbens GW, Mitnik OA. 2009. Dealing with limited overlap in estimation of average treatment effects. *Biometrika* 96(1), 187-199.
9. Das A, Rao D, Hagopian A. 2011. India's Janani Suraksha Yojana: further review needed. *The Lancet* 377(9762): 295–296.
10. Gopalan SS, Durairaj V. 2012. Addressing maternal healthcare through demand side financial incentives: experience of Janani Suraksha Yojana program in India. *BMC health services research* 12(1): 319.
11. Gupta SK, Pal DK, Tiwari R, Garg R, Sarawagi R. 2011. Assessment of Janani Suraksha Yojana (JSY) in Jabalpur, Madhya Pradesh: knowledge, attitude and utilization pattern of beneficiaries: a descriptive study. *International Journal of Current Biological and Medical Science (IJCBS)* 2011; 1(2): 06–11.
12. Gupta SK, Pal DK, Tiwari R et al. 2012. Impact of Janani Suraksha Yojana on institutional delivery rate and maternal morbidity and mortality: an observational study in India. *Journal of Health, Population and Nutrition* 30(4): 464–471.
13. Khan M, Hazra A, Bhatnagar I. 2010. Impact of Janani Suraksha Yojana on selected family health behaviors in rural Uttar Pradesh. *Journal of family welfare* 56: 9–22.
14. Lim SS, Dandona L, Hoisington JA, James SL, Hogan MC, Gakidou E. 2010. India's Janani Suraksha Yojana, a conditional cash transfer program to increase births in health facilities: an impact evaluation. *The Lancet* 375(9730): 2009–2023.
15. Love TE. 2003. Propensity Scores: What do they do, How should I use them and Why should I care?. *ASA Cleveland Chapter*.
16. Modugu HR, Kumar M, Kumar A, Millett C. 2012. State and socio-demographic group variation in out-of-pocket expenditure, borrowings and Janani Suraksha Yojana (JSY) program use for birth deliveries in India. *BMC Public Health* 12(1): 1048.

17. Nandi A, Laxminarayan R. 2016. The unintended effects of cash transfers on fertility: evidence from the Safe Motherhood Scheme in India. *Journal of Population Economics* 29(2): 457-491.
18. MoHFW 2013. *Ministry of Health & Family Welfare, Government of India*. Available at: <http://nhm.gov.in/nrhm-components/rmnch-a/maternal-health/janani-suraksha-yojana/background.html>.
19. Peña-Rosas JP, De-Regil LM, Garcia-Casal MN, Dowswell T. 2015. Daily oral iron supplementation during pregnancy. *The Cochrane Library*.
20. Powell-Jackson T, Mazumdar S, Mills A. 2015. Financial incentives in health: New evidence from India's Janani Suraksha Yojana. *Journal of health economics* 43: 154-169.
21. Rubin DB. 1974. Estimating causal effects of treatments in randomized and nonrandomized studies. *Journal of educational Psychology* 66(5): 688.
22. Rubin DB, John L. 2011. Rubin causal model. In *International encyclopedia of statistical science* 1263-1265. Springer Berlin Heidelberg.
23. Sugathan KS, Mishra VK, Retherford RD. 2001. Promoting institutional deliveries in rural India: The role of antenatal-care services.
24. Tanahashi T. 1978. Health service coverage and its evaluation. *Bulletin of the World Health Organization* 56(2): 295.
25. Van de Poel E, Flores G, Ir P, O'Donnell O, Van Doorslaer E. 2014. Can vouchers deliver? An evaluation of subsidies for maternal health care in Cambodia. *Bulletin of the World Health Organization* 92(5): 331–339.
26. World Health Organisation (WHO), 2015. Trends in Maternal Mortality: 1990 to 2015. <https://data.worldbank.org/indicator/sh.sta.mmrt>
27. Yao, X.I., Wang, X., Speicher, P.J., Hwang, E.S., Cheng, P., Harpole, D.H., Berry, M.F., Schrag, D. and Pang, H.H., 2017. Reporting and guidelines in propensity score analysis: a systematic review of cancer and cancer surgical studies. *JNCI: Journal of the National Cancer Institute*, 109(8), p.djw323.
28. Yojana JS. 2006. Ministry of Health and Family welfare. Available from the official site of the Ministry of Health and Family Welfare, Government of India; available at: [http://mohfw.nic.in/sites/default/files/17739294021483341357\\_1.pdf](http://mohfw.nic.in/sites/default/files/17739294021483341357_1.pdf).

## Tables

**Table 1** Eligibility criteria of JSY

State type	Eligibility Criteria
LPS	All pregnant women delivering in public or accredited private institutions.
HPS	(1) Household of the pregnant woman has below poverty line card, or
	(2) Household of the pregnant woman is scheduled caste, or
	(3) Household of the pregnant woman is tribe, and
	(4) The pregnant woman aged 19 years and above, and
	(5) Give birth in public or accredited private institutions, and
	(6) In every above case, receive program benefit up to second birth.

**Table 2** Scale of cash assistance under JSY (in Indian rupee)

	Rural Area			Urban Area		
State type	Mother	ASHA	Total	Mother	ASHA	Total
LPS	1,400	600	2,000	1,000	400	1,400
HPS	700	600	1,300	600	400	1,000

**Table 3** Means of basic socio-economic characteristics by JSY and non-JSY recipients

Socio-economic characteristics	JSY		Non-JSY	
	FS	RS	FS	RS
Household having below poverty line card (1 yes, 0 no)	0.469	0.458	0.318	0.306
Scheduled caste (1 yes, 0 no)	0.310	0.286	0.221	0.205
Scheduled tribe (1 yes, 0 no)	0.178	0.173	0.176	0.153
Hindu (1 yes, 0 no)	0.698	0.718	0.653	0.694
Rural (1 yes, 0 no)	0.683	0.662	0.593	0.544
Current age of woman	26.10	23.95	27.44	24.83
Years of education of woman	8.67	8.78	9.56	9.77
Years of education of husband	8.81	9.14	9.82	10.29
Parity/birth order	1.84	1.86	2.16	2.01
Total number of women	15,849	5,931	57,265	23,927
Percent	21.68%	19.86%)	78.32%	80.14%)

Note: FS indicates full sample and RS indicates reduced or final sample used in this study.

**Table 4** Results of the effects of JSY on maternal and child health components of care estimated from PSM

Outcome/Care Variable	Sample	Treated	Controls	Diff.	95% CI	p value	Deviation from the continuum of care line (%)
<b>Section 1: ANC</b>							
Pregnancy registered	Unmatched	0·959	0·857	0·102	0·093 to 0·111	0·0001	
	ATT	0·959	0·877	0·082	0·070 to 0·094	0·0001	4.1
Received at least one ANC	Unmatched	0·952	0·875	0·077	0·068 to 0·086	0·0001	
	ATT	0·952	0·888	0·064	0·052 to 0·076	0·0001	4.8
ANC visits 3	Unmatched	0·780	0·691	0·090	0·077 to 0·103	0·0001	
	ATT	0·780	0·700	0·080	0·062 to 0·099	0·0001	22.0
Weight measured	Unmatched	0·874	0·790	0·085	0·073 to 0·096	0·0001	
	ATT	0·874	0·794	0·080	0·064 to 0·095	0·0001	12.6
Height measured	Unmatched	0·588	0·495	0·092	0·078 to 0·107	0·0001	
	ATT	0·588	0·538	0·049	0·028 to 0·070	0·0001	41.2
Blood pressure checked	Unmatched	0·802	0·711	0·091	0·078 to 0·103	0·0001	
	ATT	0·802	0·736	0·066	0·048 to 0·083	0·0001	19.8
Blood tested (haemoglobin)	Unmatched	0·733	0·667	0·066	0·053 to 0·080	0·0001	

Outcome/Care Variable	Sample	Treated	Controls	Diff.	95% CI	p value	Deviation from the continuum of care line (%)
	ATT	0.733	0.666	0.068	0.048 to 0.087	0.0001	26.7
Blood tested (blood group)	Unmatched	0.675	0.595	0.080	0.066 to 0.094	0.0001	
	ATT	0.675	0.605	0.070	0.050 to 0.090	0.0001	32.5
Urine tested	Unmatched	0.773	0.707	0.066	0.053 to 0.079	0.0001	
	ATT	0.773	0.710	0.063	0.044 to 0.081	0.0001	22.7
Abdomen examined	Unmatched	0.575	0.520	0.055	0.041 to 0.069	0.0001	
	ATT	0.575	0.527	0.048	0.027 to 0.069	0.0001	42.5
Breast examined	Unmatched	0.392	0.359	0.034	0.020 to 0.047	0.0001	
	ATT	0.392	0.374	0.018	-0.002 to 0.038	0.0784	60.8
Sonogram/ultrasound done	Unmatched	0.654	0.633	0.020	0.007 to 0.034	0.0035	
	ATT	0.654	0.620	0.034	0.014 to 0.054	0.0010	34.6
Delivery date communicated	Unmatched	0.600	0.495	0.105	0.090 to 0.119	0.0001	
	ATT	0.600	0.542	0.058	0.037 to 0.079	0.0001	40.0
Iron Folic Acid tablet/syrup	Unmatched	0.789	0.661	0.127	0.114 to 0.141	0.0001	



Outcome/Care Variable	Sample	Treated	Controls	Diff.	95% CI	p value	Deviation from the continuum of care line (%)
	ATT	0.789	0.700	0.089	0.070 to 0.107	0.0001	21.1
At least one tetanus injection	Unmatched	0.924	0.839	0.085	0.075 to 0.095	0.0001	
	ATT	0.924	0.840	0.084	0.070 to 0.098	0.0001	7.6
Tetanus injection 3	Unmatched	0.191	0.137	0.054	0.043 to 0.064	0.0001	
	ATT	0.191	0.164	0.026	0.010 to 0.042	0.0015	80.9
<b>Section 2: Antenatal advice</b>							
Delivery advice	Unmatched	0.509	0.398	0.111	0.097 to 0.125	0.0001	
	ATT	0.509	0.454	0.055	0.034 to 0.076	0.0001	49.1
Breastfeeding advice	Unmatched	0.607	0.508	0.098	0.084 to 0.113	0.0001	
	ATT	0.607	0.549	0.057	0.037 to 0.078	0.0001	39.3
Advice for keeping baby warm	Unmatched	0.570	0.475	0.096	0.081 to 0.110	0.0001	
	ATT	0.570	0.515	0.055	0.034 to 0.076	0.0001	43.00
Advice for cleanliness at delivery time	Unmatched	0.524	0.420	0.104	0.090 to 0.118	0.0001	
	ATT	0.524	0.459	0.065	0.044 to 0.086	0.0001	47.6

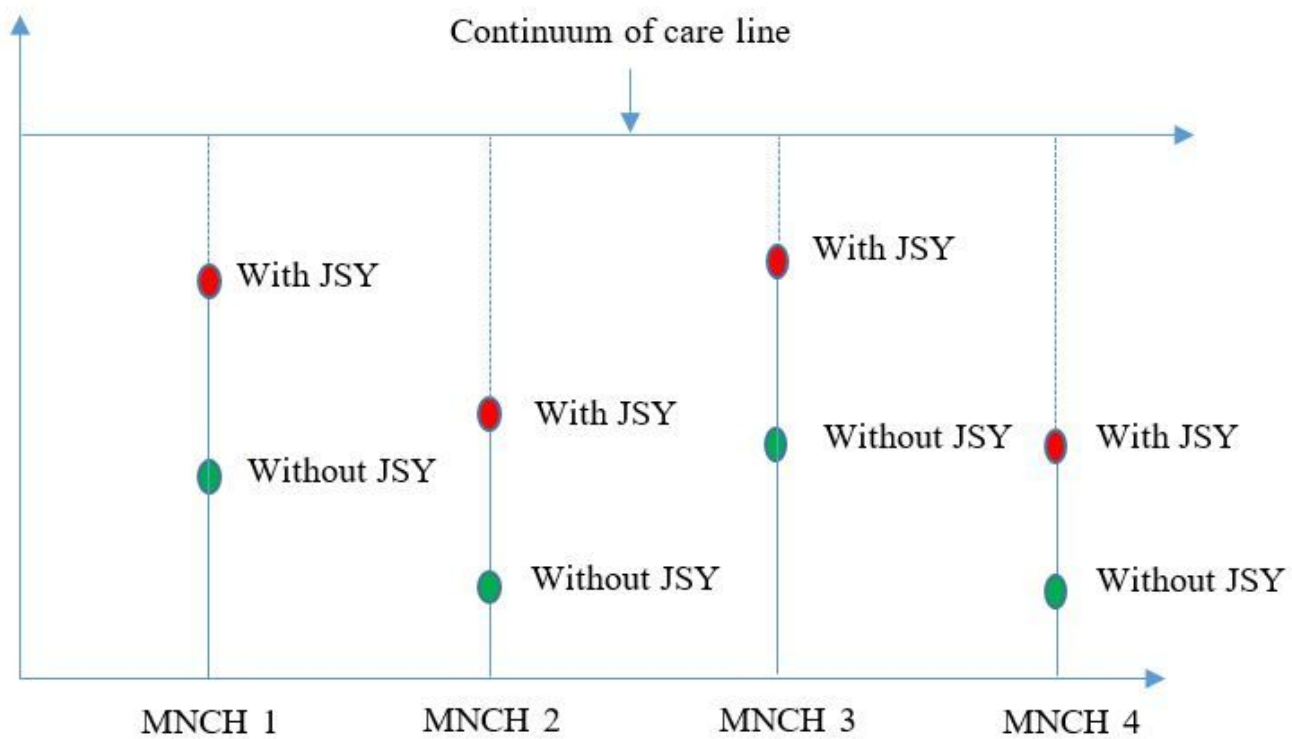
Outcome/Care Variable	Sample	Treated	Controls	Diff.	95% CI	p value	Deviation from the continuum of care line (%)
Advice for Family Planning for spacing	Unmatched	0·460	0·368	0·093	0·079 to 0·107	0·0001	
	ATT	0·460	0·404	0·056	0·035 to 0·077	0·0001	54.0
Advice for Family Planning for limiting	Unmatched	0·400	0·323	0·077	0·063 to 0·090	0·0001	
	ATT	0·400	0·359	0·041	0·021 to 0·061	0·0001	60.0
Advice for better nutrition	Unmatched	0·477	0·366	0·111	0·097 to 0·124	0·0001	
	ATT	0·477	0·427	0·050	0·029 to 0·070	0·0001	52.3
Advice for institutional delivery	Unmatched	0·374	0·277	0·097	0·084 to 0·110	0·0001	
	ATT	0·374	0·303	0·071	0·051 to 0·091	0·0001	37.4
<b>Section 3: Postnatal care and advice for mother</b>							
Institutional delivery	Unmatched	0·953	0·836	0·117	0·107 to 0·127	0·0001	
	ATT	0·953	0·836	0·118	0·104 to 0·131	0·0001	4.7
Check-up after birth in facility	Unmatched	0·769	0·687	0·082	0·069 to 0·095	0·0001	
	ATT	0·769	0·670	0·099	0·080 to 0·118	0·0001	23.1
Check-up in 48 hours of delivery	Unmatched	0·729	0·638	0·091	0·078 to 0·105	0·0001	

Outcome/Care Variable	Sample	Treated	Controls	Diff.	95% CI	p value	Deviation from the continuum of care line (%)
	ATT	0·729	0·622	0·107	0·087 to 0·126	0·0001	27.1
Abdomen examined	Unmatched	0·492	0·415	0·077	0·063 to 0·091	0·0001	
	ATT	0·492	0·427	0·065	0·045 to 0·085	0·0001	50.8
Advice on breastfeeding	Unmatched	0·498	0·413	0·084	0·070 to 0·099	0·0001	
	ATT	0·498	0·426	0·072	0·052 to 0·093	0·0001	50.2
Advice on baby care	Unmatched	0·472	0·404	0·067	0·053 to 0·081	0·0001	
	ATT	0·472	0·396	0·076	0·056 to 0·097	0·0001	52.8
Advice on Family Planning	Unmatched	0·363	0·279	0·084	0·071 to 0·097	0·0001	
	ATT	0·363	0·286	0·078	0·058 to 0·097	0·0001	63.7
<b>Section 4: Postnatal care for child</b>							
Check-up after delivery	Unmatched	0·859	0·799	0·060	0·049 to 0·072	0·0001	
	ATT	0·859	0·799	0·060	0·044 to 0·076	0·0001	14.1
Number of check-ups 2	Unmatched	0·503	0·462	0·041	0·027 to 0·056	0·0001	
	ATT	0·503	0·456	0·048	0·027 to 0·068	0·0001	49.7

Outcome/Care Variable	Sample	Treated	Controls	Diff.	95% CI	p value	Deviation from the continuum of care line (%)
Weight taken at birth	Unmatched	0·929	0·815	0·114	0·104 to 0·125	0·0001	
	ATT	0·929	0·833	0·096	0·082 to 0·110	0·0001	7.1
Still breastfeeding to child	Unmatched	0·502	0·464	0·039	0·025 to 0·053	0·0001	
	ATT	0·502	0·469	0·034	0·013 to 0·054	0·0013	49.8
Breast feeding 6 months	Unmatched	0·466	0·469	-0·003	-0·017 to 0·012	0·7263	
	ATT	0·466	0·459	0·007	-0·014 to 0·027	0·5353	53.4
Woman got information about diarrhoea	Unmatched	0·573	0·610	-0·037	-0·051 to -0·023	0·0001	
	ATT	0·573	0·522	0·052	0·031 to 0·072	0·0001	42.7
Woman got information about pneumonia	Unmatched	0·305	0·348	-0·043	-0·057 to -0·030	0·0001	
	ATT	0·305	0·276	0·028	0·010 to 0·046	0·0024	69.5
<b>Section 5: Immunizations/ interventions for children</b>							
BCG	Unmatched	0·976	0·957	0·019	0·014 to 0·025	0·0001	
	ATT	0·976	0·954	0·022	0·014 to 0·030	0·0001	2.4
Polio	Unmatched	0·977	0·963	0·014	0·009 to 0·020	0·0001	

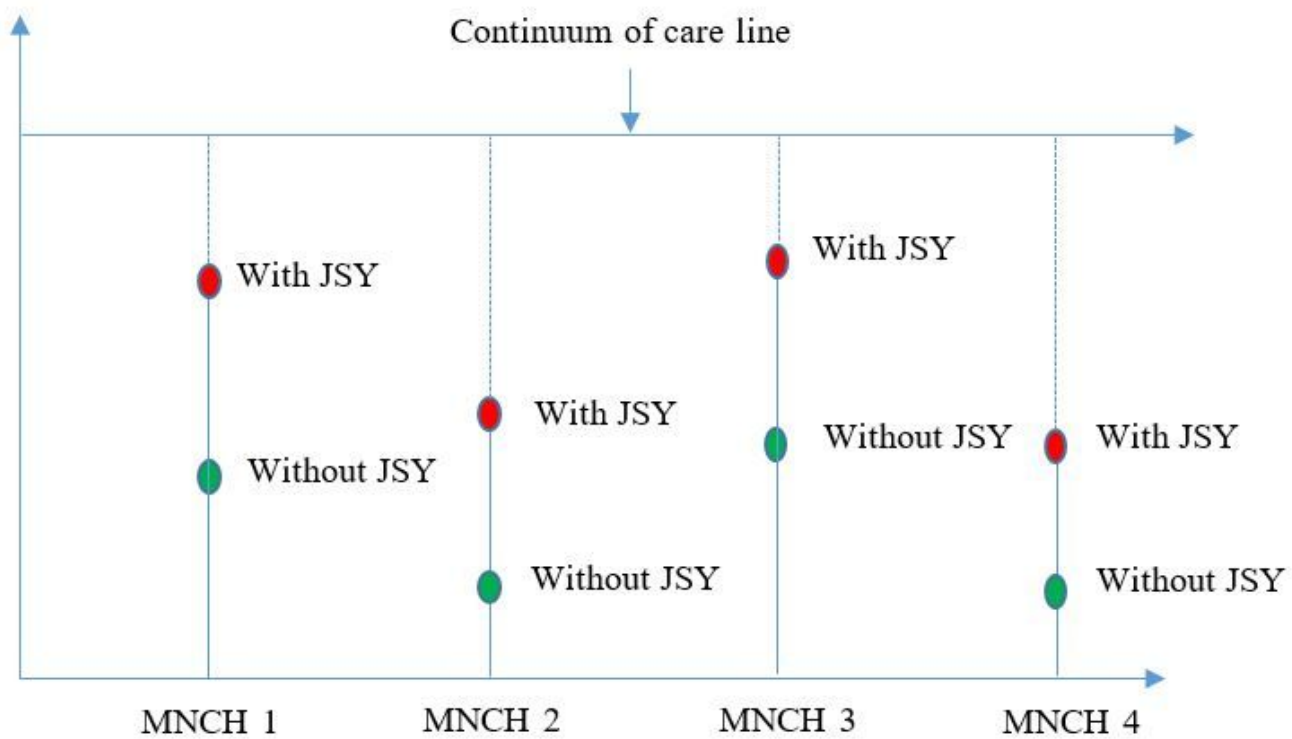
Outcome/Care Variable	Sample	Treated	Controls	Diff.	95% CI	p value	Deviation from the continuum of care line (%)
	ATT	0·977	0·959	0·018	0·010 to 0·026	0·0001	2.3
First Polio in two weeks of birth	Unmatched	0·813	0·771	0·042	0·030 to 0·054	0·0001	
	ATT	0·813	0·769	0·043	0·026 to 0·060	0·0001	18.7
DPT	Unmatched	0·911	0·880	0·031	0·022 to 0·041	0·0001	
	ATT	0·911	0·873	0·038	0·025 to 0·051	0·0001	8.9
Measles	Unmatched	0·878	0·828	0·050	0·040 to 0·061	0·0001	
	ATT	0·878	0·842	0·036	0·021 to 0·051	0·0001	12.2
Hepatitis-B	Unmatched	0·789	0·743	0·046	0·034 to 0·058	0·0001	
	ATT	0·789	0·749	0·040	0·022 to 0·057	0·0001	21.1
Vitamin-A	Unmatched	0·743	0·695	0·048	0·035 to 0·061	0·0001	
	ATT	0·743	0·686	0·056	0·037 to 0·076	0·0001	25.7

## Figures



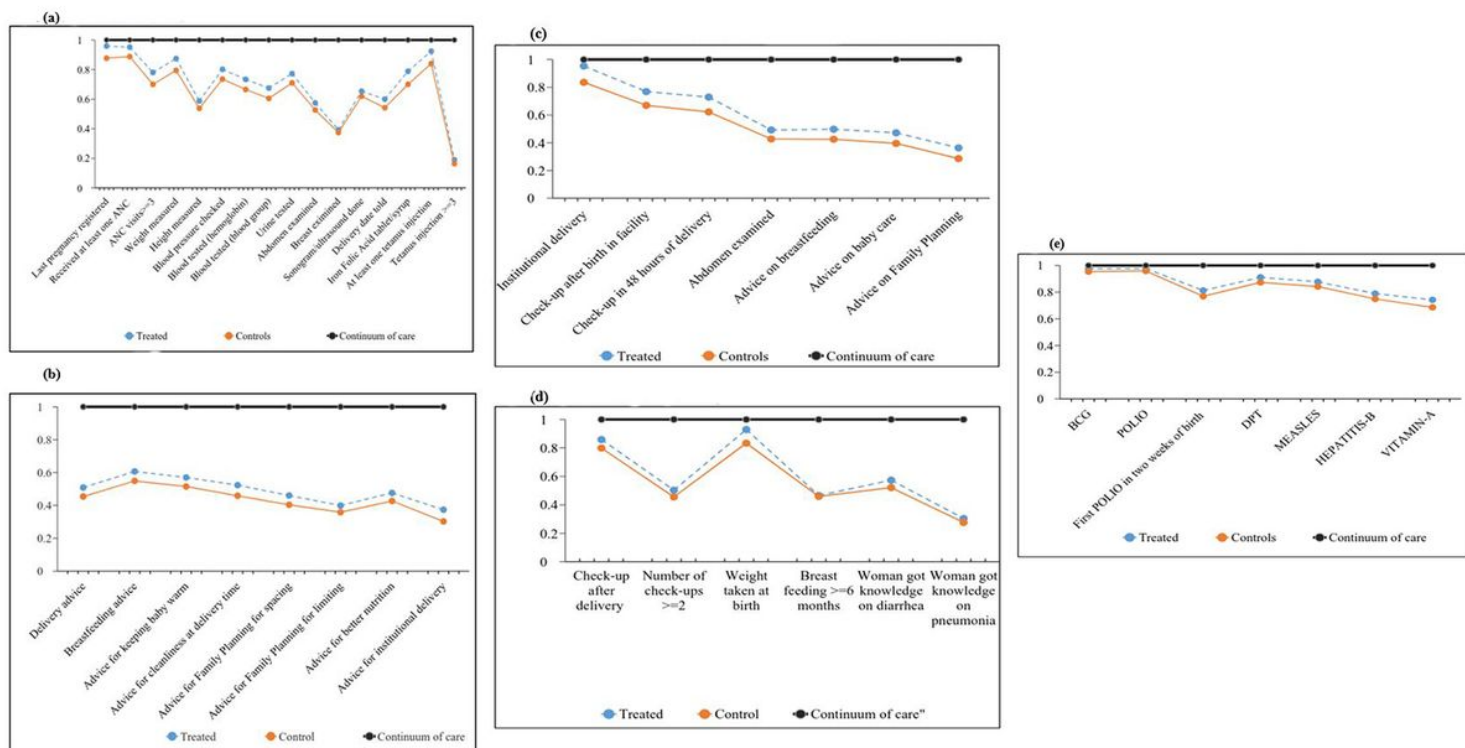
**Figure 1**

Conceptual framework on the continuum of care for MNCH



**Figure 1**

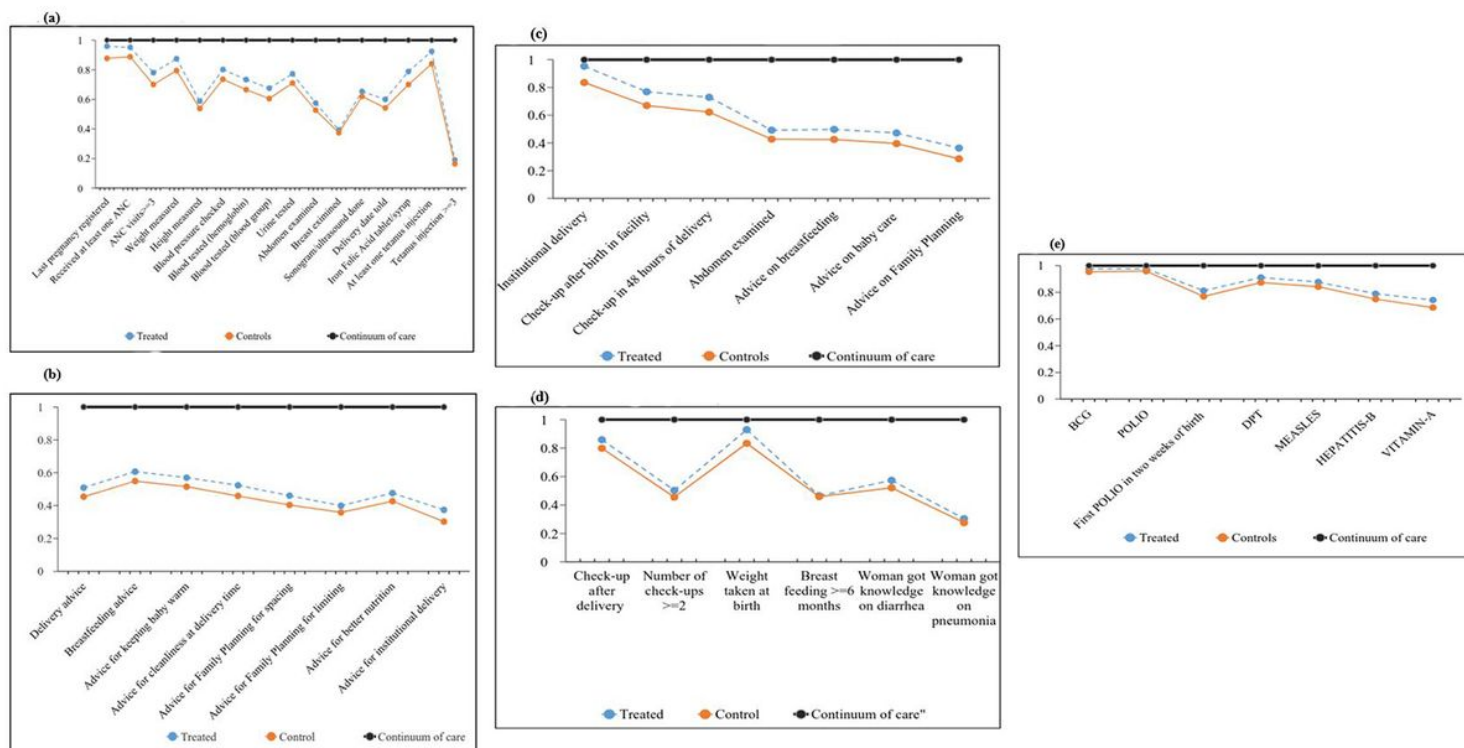
Conceptual framework on the continuum of care for MNCH



**Figure 2**

(a) ANC Service uptake (b) ANC Advice uptake (c) Uptake of institutional delivery, postnatal care and advice for the mother (d) Postnatal care for the child (e) Immunisation and Vitamin A for the child





**Figure 2**

(a) ANC Service uptake (b) ANC Advice uptake (c) Uptake of institutional delivery, postnatal care and advice for the mother (d) Postnatal care for the child (e) Immunisation and Vitamin A for the child

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