A reassessment of India's Janani Suraksha Yojana conditional cash transfer program: State-level effects matter

April 28, 2011

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Abstract

There have been few formal assessments of India's Janani Suraksha Yojana (JSY), a national-level conditional cash transfer program to incentivize women to deliver in health facilities in order to reduce maternal and neonatal mortality. Using data from India's 2007-2008 District-Level Household Survey (DLHS-3), we undertake a reassessment of JSY based on a recent impact evaluation (Lim 2010). The impact of JSY and the characteristics of women reporting receipt of financial assistance from JSY were previously reported at the national level (Lim 2010). We demonstrate that there was great heterogeneity in JSY uptake across the Indian states. Further, our results show that the impact of JSY on increasing antenatal care, in-facility birth, and skilled birth attendance also varies widely across states. Assessments of the uptake and impact of JSY should be carefully contextualized to the appropriate setting to allow for more informed policy insight in order to improve program implementation at the state and national level.

Introduction

Conditional cash transfer programs are one example of innovative incentive mechanisms with high hopes of being a powerful mechanism to improve health outcomes in developing countries. Fernald (2008) reported that the conditional cash transfer program in Mexico, known as Oportunidades, was very successful in improving child health, growth and development. Since then, there has been an increase in the number of conditional cash transfer programs in low- and middle-income countries to improve population health that have focused on a variety of health problems. A recent review of twenty-eight conditional cash transfer programs by Lagarde (2007) showed that overall the evidence suggests that conditional cash transfer programs are effective in increasing the use of preventive services and sometimes improving health status. In addition to short-term health outcomes, a recent study by Fernald (2009) to evaluate a long-term impact of conditional cash transfer program, Oportunidades, demonstrated that it had long-term independent beneficial effects other than increased income, especially for women with no formal education. This evidence is suggestive of potential huge benefits of conditional cash transfer programs.

India's Janani Suraksha Yojana (JSY) is a nation-wide conditional cash transfer program that was established in mid-2005 with the goal of improving maternal and neonatal health outcomes. The program has been implemented differently across states, with varying eligibility and reimbursement criteria: in ten states defined as high focus, all women are eligible for the program; in the remaining states, eligibility and reimbursement varies depending on urban or rural status, birth order, below-the-poverty-line card ownership, maternal age, and caste or tribe. (Government of India 2006) An early analysis of the program impact by Lim (2010) using data from two rounds of the India district-level household surveys (DLHS) showed that JSY had a significant effect on increasing antenatal care and in-facility births. The analysis showed that implementation of JSY in 2007-08 varied greatly by state - from less than 5% to up to 44% of women giving birth receiving cash payments from JSY. At the national level, they found that the poorest and least educated women did not always have the highest odds of receiving JSY payments and showed that maternal age, the number of livebirths, maternal education, wealth, caste, religion and geographic area (urban or rural) are all significant in determining the uptake of JSY.

We hypothesize that since the implementation of the program and the characteristics of the eligible population does vary greatly from state to state, the association of maternal age, the number of livebirths, maternal education, wealth, and geographic area and JSY uptake could also vary widely across states. While in aggregate each of these characteristics may have a significant association with the uptake of JSY, this may not necessarily be true for each individual state. Therefore, analyzing the impact of each population characteristic on the uptake of JSY at the national level could be misleading and misguide future priority setting. In addition, the varying degrees of implementation between states could create big discrepancies in the impact of receipt of JSY on maternal health outcomes. Again, a national-level analysis would not capture the vast differences in JSY impact that a state-specific analysis would.

Our analysis first replicated the author's original national-level analysis of both JSY uptake and impact of JSY on maternal health outcomes. We then performed analyses to first compare the association of individual-level and household-level characteristics (maternal age, number of live births, maternal education, wealth

decile, urban or rural residence and district mean income) on the uptake of JSY among states to show that state-level estimates of JSY uptake differ widely from the national level estimates. This will be important for policy implications in that each particular state needs to focus on different population characteristics in order to improve JSY receipt uptake. We also evaluated the treatment effect of JSY at the state-level for the maternal health outcomes of antenatal care, in-facility birth, and skilled birth attendance and compared these results to the previously-obtained national-level results (Lim 2010). We evaluated the difference in JSY impact with our state-specific model and compared the model fit with the national model.

Methods

Characteristics of Janani Suraksha Yojana beneficiaries

National Level

Lim (2010) assessed the socioeconomic and demographic characteristics of women reporting receipt of financial assistance from JSY using the DLHS-3. According to the paper, district-level and state-level JSY uptake were calculated using only births from the last 12 months prior to the survey in order to reduce biases associated with differential implementation of the scheme, and ensure that the only active maternity benefit scheme at the time was JSY. We replicated the analysis done by the authors, using logistic regression to investigate the association between a womans report of receipt of financial assistance from JSY for her most recent birth and the same individual- and household-level characteristics used by the authors (Lim 2010). We estimated the regression at the national level as well as for the high focus states, remote northeast states, and other states, using state-fixed effects to increase comparability between our results and the Lim (2010) paper. We ran the regression on the restricted dataset (consisting only of most recent birth from the 12 months prior to the survey) and also on the unrestricted data (most recent birth after January 1, 2004). We present and compare our results for both the restricted and unrestricted samples for the national-level and high focus states regressions, compared to the authors' original results.

State Level

We further explored and compared the magnitudes of differences and of risk ratios for the association of maternal characteristics and JSY uptake in state-specific models. We analayzed differences and risk ratios for five characteristics (maternal age group, the number of livebirths, maternal education, wealth and urban residence) in five high focus states (Uttar Pradesh, Bihar, Madhya Pradesh, Rajasthan and Orissa) and restricted only to the women who gave births in the last 12 months before the survey date to avoid the bias that we have demonstrated previously.

Measurement of impact of Janani Suraksha Yojana

National Level

Lim (2010) reported the impact of JSY uptake on health outcomes (antenatal care visits for at least 3 visits, in facility births, skilled birth attendance, perinatal death per 1000 pregnancies, and neonatal birth per 1000 livebirhts) by using exact matching to improve model dependence and then performing a logistic

regression on the matched data. Lim (2010) estimate the effect of JSY on health outcomes by calculating the difference in health outcomes between the women who received JSY assistance and those who did not receive JSY assistance while setting other covariates to be at the means. This method makes interpretation of the subsequent results difficult because most of the covariates used are nominal variables that do not have a clear mean. We used an alternative approach to estimate the impact of JSY assistance on individual-level health outcomes using Zelig (Zelig) which calculates the treatment effect difference by setting factor-level covariates (maternal age group, the number of live birth, maternal education, caste/tribe, geographic area of residence) at their mode and the continuous variable (district mean household wealth) at its mean. The mode of the states was Uttar Pradesh, which accounts for over 22% of the sample of women in the dataset. We ran these analyses in both the restricted and unrestricted datasets to evaluate whether the impact of JSY changed during these two analyses.

State Level

We further investigated the impact of JSY at the state-level, using the same methods as the national-level estimation and including district-level fixed effects in our logistic model. Because we obtained comparable results between the unrestricted and the dataset restricted to births in the past 12 months, we chose to run these impact evaluation analyses on the unrestricted datasets. (Appendix) Some states had very low sample sizes, and thus analyzing on the unrestricted data allows us to increase the power of these analyses.

Results

Characteristics of Janani Suraksha Yojana beneficiaries

National Level

We find that although Lim (2010) report restricting their analysis to births within the past 12 months, they do so inconsistently, at times presenting results for the restricted dataset while at other times presenting results for the unrestricted dataset. The receipt of financial assistance from JSY by individual-level characteristics, presented in the authors' Figure 3, were found to be based on the unrestricted dataset among all births after January 1, 2004, as opposed to births in the last 12 months, as claimed. After we restricted the data to only births occurring in the past 12 months, while the overall trends of percentage JSY uptake across individual-level characteristics remain consistent, we find the authors' estimates to have underestimated the true proportion of women reporting receipt of JSY (Appendix). When we restricted the data, receipt of JSY increased across all women's characteristics.

Results from the multivariable logistic regression analysis of financial receipt of JSY on the same group of individual and household-level characteristics also reveal that the regression was conducted on the unrestricted dataset. In this case, the authors had not specified that only births in the last 12 months were included in the regression. After we restricted the data to only these births, we found differences in estimated odds ratios and their significance for all states and high focus states (Table 1 and Table 2, respectively). While age was found to be significantly associated with financial assistance in the unrestricted dataset, with women at younger ages more likely to report receipt of JSY, there was no association between maternal age

and receipt of financial assistance from JSY when only births in the past 12 months were included. We also found that many of the odds ratios were overestimated by using unrestricted data (Figure 1). This finding was most clear for all states (left graph) compared to high focus states.

	Unrestricted Dataset Odds Ratio(95% CI)	p-value	Restricted Dataset Odds Ratio(95% CI)	p-value
Maternal Age (years)				
15-19	1.58 (1.44-1.72)	<0.0001	0.94 (0.82-1.07)	0.329
20-24	1.33 (1.24-1.42)	<0.0001	0.99 (0.89-1.11)	0.8971
25-29	1.12 (1.05-1.19)	0.0005	1.06 (0.96-1.17)	0.2521
35-39	0.84 (0.76-0.94)	0.0013	0.95 (0.8-1.12)	0.5444
40-44	0.76 (0.63-0.92)	0.0044	0.94 (0.68-1.29)	0.7106
Number of live births				
1	1.00	..	1.00	..
2	0.86 (0.82-0.9)	<0.0001	0.86 (0.81-0.93)	<0.0001
3 to 5	0.55 (0.52-0.59)	<0.0001	0.55 (0.5-0.6)	<0.0001
5 or more	0.54 (0.48-0.6)	<0.0001	0.54 (0.47-0.63)	<0.0001
Maternal Education (years)				
No Education	1.00	..	1.00	..
1-5	1.22 (1.15-1.29)	<0.0001	1.23 (1.13-1.34)	<0.0001
6-11	1.41 (1.34-1.48)	<0.0001	1.56 (1.44-1.68)	<0.0001
>=12 years	1.25 (1.15-1.36)	<0.0001	1.36 (1.2-1.55)	<0.0001
Household wealth (decile)				
Poorest	1.00	..	1.00	..
2	0.97 (0.89-1.05)	0.4	1.07 (0.96-1.2)	0.2417
3	1.05 (0.97-1.13)	0.2474	1.15 (1.03-1.28)	0.013
4	1.05 (0.97-1.13)	0.2542	1.15 (1.03-1.3)	0.016
5	1.12 (1.03-1.21)	0.0062	1.16 (1.03-1.31)	0.0124
6	1.12 (1.03-1.22)	0.0083	1.19 (1.05-1.35)	0.0057
7	1.11 (1.02-1.21)	0.0169	1.21 (1.07-1.38)	0.0032
8	1.03 (0.94-1.13)	0.5658	1.07 (0.93-1.24)	0.3188
9	0.72 (0.65-0.81)	<0.0001	0.74 (0.63-0.87)	2e-04
Richest	0.52 (0.46-0.6)	<0.0001	0.51 (0.42-0.62)	<0.0001
Caste/Tribe				
Scheduled Caste	1.39 (1.31-1.48)	<0.0001	1.37 (1.24-1.5)	<0.0001
Scheduled Tribe	1.22 (1.14-1.3)	<0.0001	1.11 (1-1.24)	0.0438
Other backward class	1.14 (1.08-1.21)	<0.0001	1.16 (1.07-1.25)	0.0004
Other	1.00	..	1.00	..
Religion				
Hindu	1.00	..	1.00	..
Muslim	0.75 (0.7-0.8)	<0.0001	0.72 (0.65-0.79)	<0.0001
Christian	0.89 (0.8-1)	0.0587	0.79 (0.65-0.95)	0.0148
Sikh	0.82 (0.63-1.06)	0.1251	0.8 (0.54-1.17)	0.2452
Buddhist/neo-buddhist	1.12 (0.93-1.34)	0.2417	0.96 (0.68-1.36)	0.8193
Other	0.96 (0.77-1.18)	0.6901	0.75 (0.52-1.08)	0.1232
Urban Residence	0.94 (0.89-1)	0.0502	1.04 (0.95-1.14)	0.3533
District Mean Household Wealth	0.87 (0.82-0.92)	<0.0001	0.93 (0.85-1.01)	0.081
State				
Andaman & Nicobar Islands	1.56 (1.01-2.43)	0.0474	0.4 (0.14-1.1)	0.0757
Andhra Pradesh	6.56 (5.84-7.36)	<0.0001	2.86 (2.39-3.43)	<0.0001
Arunachal Pradesh	1.82 (1.47-2.25)	<0.0001	1.16 (0.78-1.73)	0.4716
Assam	6.54 (5.93-7.21)	<0.0001	6.37 (5.56-7.3)	<0.0001
Bihar	1.86 (1.69-2.06)	<0.0001	2.4 (2.13-2.7)	<0.0001
Chandigarh	0.94 (0.23-3.93)	0.9341	...	...
Chhattisgarh	1.87 (1.63-2.14)	<0.0001	1.58 (1.31-1.9)	<0.0001
Dadra & Nagar Haveli	1.78 (0.97-3.25)	0.0626	0.95 (0.34-2.68)	0.9197
Daman & Diu	0.69 (0.35-1.33)	0.2647	0.46 (0.18-1.2)	0.114
Delhi	1.39 (0.95-2.02)	0.0894	0.71 (0.4-1.28)	0.2565
Goa	1.12 (0.5-2.53)	0.7791	0.09 (0.01-0.69)	0.0201
Gujarat	2.51 (2.21-2.86)	<0.0001	1.66 (1.38-2)	<0.0001
Haryana	1.4 (1.16-1.69)	0.0005	0.83 (0.63-1.11)	0.2077
Himachal Pradesh	1.45 (1.15-1.84)	0.0019	0.73 (0.5-1.07)	0.1021
Jammu & Kashmir	0.98 (0.77-1.24)	0.8659	0.35 (0.22-0.54)	<0.0001
Jharkhand	0.65 (0.55-0.77)	<0.0001	0.52 (0.42-0.65)	<0.0001
Karnataka	3.54 (3.16-3.95)	<0.0001	1.9 (1.61-2.24)	<0.0001
Kerala	4.11 (3.51-4.81)	<0.0001	1.81 (1.4-2.33)	<0.0001
Lakshadweep	1.42 (0.8-2.52)	0.2366	0.48 (0.15-1.54)	0.2187
Madhya Pradesh	8.89 (8.19-9.66)	<0.0001	10.7 (9.6-11.94)	<0.0001
Maharashtra	2.14 (1.89-2.42)	<0.0001	1.32 (1.1-1.58)	0.0026
Manipur	1.56 (1.26-1.93)	<0.0001	0.65 (0.44-0.96)	0.0289
Meghalaya	0.8 (0.58-1.11)	0.1817	0.58 (0.34-1)	0.0495
Mizoram	9.29 (7.78-11.08)	<0.0001	7.16 (5.39-9.51)	<0.0001
Orissa	7.25 (6.61-7.95)	<0.0001	8.86 (7.82-10.05)	<0.0001
Pondicherry	4.33 (3.35-5.6)	<0.0001	1.19 (0.7-2.01)	0.5245
Punjab	0.91 (0.69-1.18)	0.4677	0.42 (0.27-0.63)	<0.0001
Rajasthan	7.54 (6.91-8.23)	<0.0001	7.51 (6.69-8.43)	<0.0001
Sikkim	7.39 (6.11-8.93)	<0.0001	4.59 (3.31-6.37)	<0.0001
Tamil Nadu	7.19 (6.43-8.04)	<0.0001	3.62 (3.07-4.28)	<0.0001
Tripura	2.34 (1.87-2.91)	<0.0001	1.77 (1.26-2.48)	0.001
Uttar Pradesh	1.00	..	1.00	..
Uttarakhand	2.43 (2.07-2.86)	<0.0001	1.78 (1.42-2.24)	<0.0001
West Bengal	3.37 (3.01-3.78)	<0.0001	3.54 (3.02-4.16)	<0.0001
	(N=182764)		(N=57864)	

Table 1 – Multivariable logistic regression of association between receipt of financial assistance from JSY at the national level by women for their most recent birth and individual characteristics by use of round three of the district-level household survey (200709)

	Unrestricted		Restricted	
	Odds Ratio(95% CI)	p-value	Odds Ratio(95% CI)	p-value
Maternal Age (years)				
15-19	1.88 (1.68-2.11)	<0.0001	1.02 (0.88-1.19)	0.7966
20-24	1.44 (1.32-1.56)	<0.0001	1.04 (0.92-1.18)	0.5143
25-29	1.15 (1.07-1.25)	2e-04	1.11 (0.99-1.24)	0.0878
30-34	1.00	..	1.00	..
35-39	0.85 (0.75-0.96)	0.0075	0.99 (0.82-1.2)	0.9396
40-44	0.76 (0.62-0.95)	0.0133	0.89 (0.63-1.25)	0.5039
Number of live births				
1	1.00	..	1.00	..
2	0.76 (0.71-0.81)	<0.0001	0.79 (0.72-0.86)	<0.0001
3 to 5	0.65 (0.6-0.69)	<0.0001	0.66 (0.6-0.73)	<0.0001
5 or more	0.66 (0.59-0.75)	<0.0001	0.68 (0.58-0.8)	<0.0001
Maternal Education (years)				
No Education	1.00	..	1.00	..
1-5	1.25 (1.17-1.33)	<0.0001	1.28 (1.16-1.4)	<0.0001
6-11	1.47 (1.38-1.56)	<0.0001	1.57 (1.43-1.71)	<0.0001
>=12 years	1.46 (1.3-1.64)	<0.0001	1.49 (1.27-1.75)	<0.0001
Household wealth (decile)				
Poorest	1.00	..	1.00	..
2	0.94 (0.86-1.02)	0.1297	0.98 (0.87-1.11)	0.7921
3	1.01 (0.93-1.1)	0.7367	1.09 (0.97-1.22)	0.1547
4	1.01 (0.93-1.11)	0.7693	1.12 (0.99-1.28)	0.0696
5	1.06 (0.96-1.16)	0.2665	1.1 (0.97-1.26)	0.1512
6	1.08 (0.98-1.2)	0.1306	1.18 (1.02-1.36)	0.0221
7	1.09 (0.99-1.22)	0.0905	1.19 (1.02-1.38)	0.0239
8	1 (0.89-1.12)	0.9668	1.04 (0.88-1.24)	0.6458
9	0.81 (0.71-0.92)	0.0017	0.86 (0.71-1.04)	0.1146
Richest	0.61 (0.51-0.72)	<0.0001	0.59 (0.46-0.76)	1e-04
Caste/Tribe				
Scheduled Caste	1.33 (1.23-1.44)	<0.0001	1.21 (1.09-1.36)	6e-04
Scheduled Tribe	1.13 (1.04-1.22)	0.0042	0.93 (0.83-1.05)	0.2718
Other backward class	1.17 (1.1-1.25)	<0.0001	1.12 (1.02-1.23)	0.0192
Other	1.00	..	1.00	..
Religion				
Hindu	1.00	..	1.00	..
Muslim	0.8 (0.74-0.88)	<0.0001	0.68 (0.6-0.77)	<0.0001
Christian	0.78 (0.62-0.98)	0.0298	0.62 (0.44-0.88)	0.007
Sikh	0.43 (0.25-0.74)	0.0024	0.42 (0.21-0.83)	0.0134
Buddhist/neo-buddhist	3.82 (2.21-6.6)	<0.0001	2.14 (0.62-7.41)	0.2282
Other	1.3 (0.99-1.71)	0.0576	0.88 (0.55-1.39)	0.5729
Urban Residence	1.11 (1.03-1.21)	0.0105	1.06 (0.94-1.2)	0.323
District Mean Household Wealth	0.89 (0.83-0.96)	0.0018	0.96 (0.86-1.06)	0.4109
State				
Assam	6.86 (6.21-7.58)	<0.0001	6.62 (5.76-7.6)	<0.0001
Bihar	1.91 (1.73-2.11)	<0.0001	2.45 (2.17-2.76)	<0.0001
Chhattisgarh	2 (1.74-2.28)	<0.0001	1.71 (1.42-2.06)	<0.0001
Jammu & Kashmir	0.83 (0.65-1.06)	0.1454	0.33 (0.21-0.5)	<0.0001
Jharkhand	0.66 (0.55-0.78)	<0.0001	0.55 (0.44-0.7)	<0.0001
Madhya Pradesh	9.13 (8.41-9.92)	<0.0001	11.02 (9.88-12.29)	<0.0001
Orissa	7.83 (7.13-8.6)	<0.0001	9.42 (8.3-10.69)	<0.0001
Rajasthan	7.75 (7.09-8.48)	<0.0001	7.58 (6.73-8.52)	<0.0001
Uttar Pradesh	1.00	..	1.00	..
Uttarakhand	2.46 (2.08-2.9)	<0.0001	1.7 (1.35-2.15)	<0.0001
	(N=111800)		(N=36762)	

Table 2 – Multivariable logistic regression of association between receipt of financial assistance from JSY by women for their most recent birth and individual characteristics by use of round three of the district-level household survey (2007–09) for High Focus States

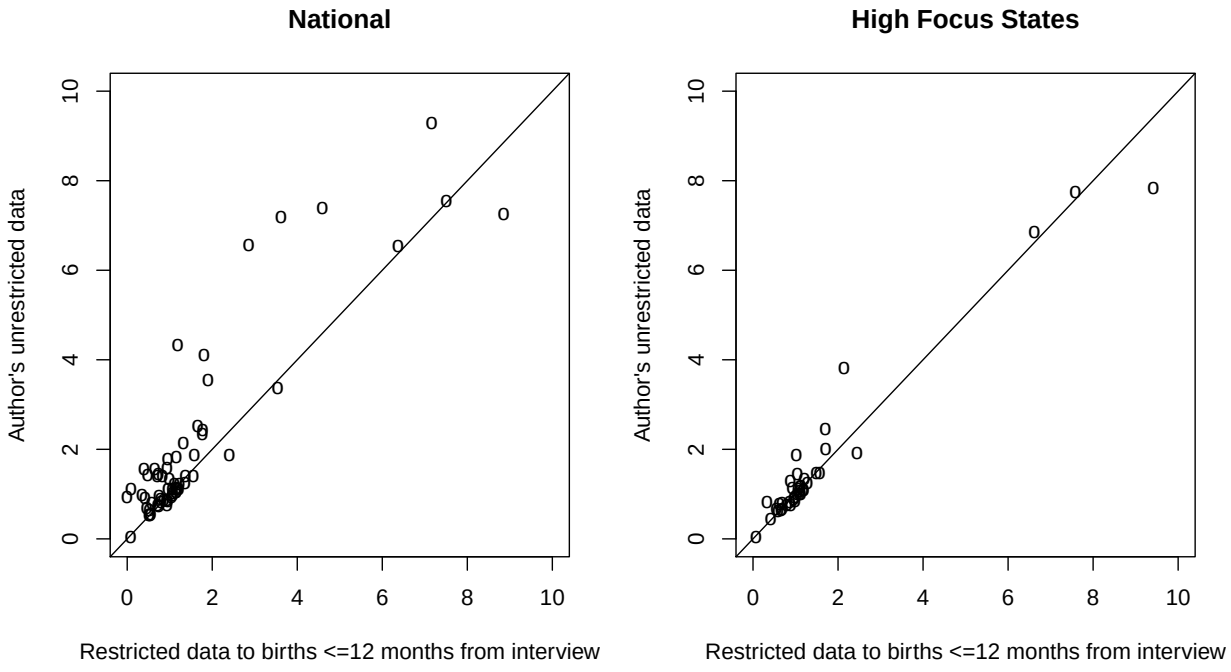

Figure 1 – Odds Ratio estimates for covariates on JSY uptake for full (unrestricted) dataset vs dataset restricted to births <=12 months from date of interview, for National and High Focus States

State Level

Lim (2010) notes large variations in JSY uptake across states, ranging from 44% in some high focus states to below 5% for several states. However, showing the proportion of women reporting financial receipt from JSY for their most recent delivery in a heath facility alone is misleading. Several of the states reporting low uptake of JSY already have high proportions of in-facility deliveries. (Figure 2)

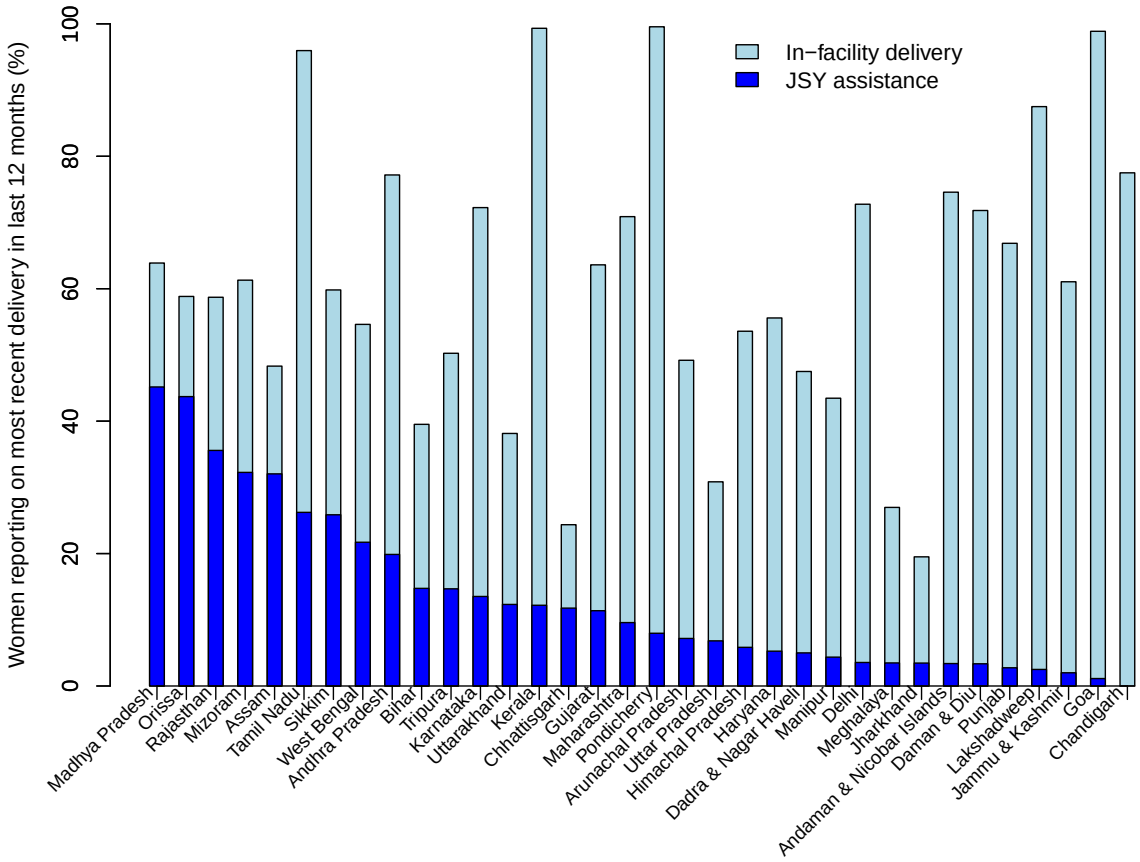

Figure 2 – JSY uptake and in-facility delivery across states

Figure 3 shows the distribution of odds ratios for the state-specific models compared to the national level model for several individual- and household-level characteristics of women included in the models (maternal age, number of live births, maternal education, wealth decile, urban or rural residence and district mean income) on JSY uptake.

We found that the difference in probability of uptake and the risk ratios for the lowest to highest odds of receiving JSY for each of the five characteristics varied widely among states (Appendix). For example, the difference in the uptake rate of JSY between age groups in Bihar state was 9.20% while the difference in the uptake rate of JSY between age groups in Madhya Pradesh was 18.62%. Indeed, the specific group of women that was least likely to receive JSY assistance in one state may be the group of women who was most likely to receive JSY assistance in the other state. For instance, women in the age group 15-19 years old were least likely to receive JSY assistance in Orissa but women in this age group were most likely (compared to other age groups) to receive JSY assistance in Bihar and Madhya Pradesh. All the results above suggest that characteristics significantly associated with JSY uptake varied greatly between states, and thus warrants a state-specific analysis in order to best improve JSY uptake.

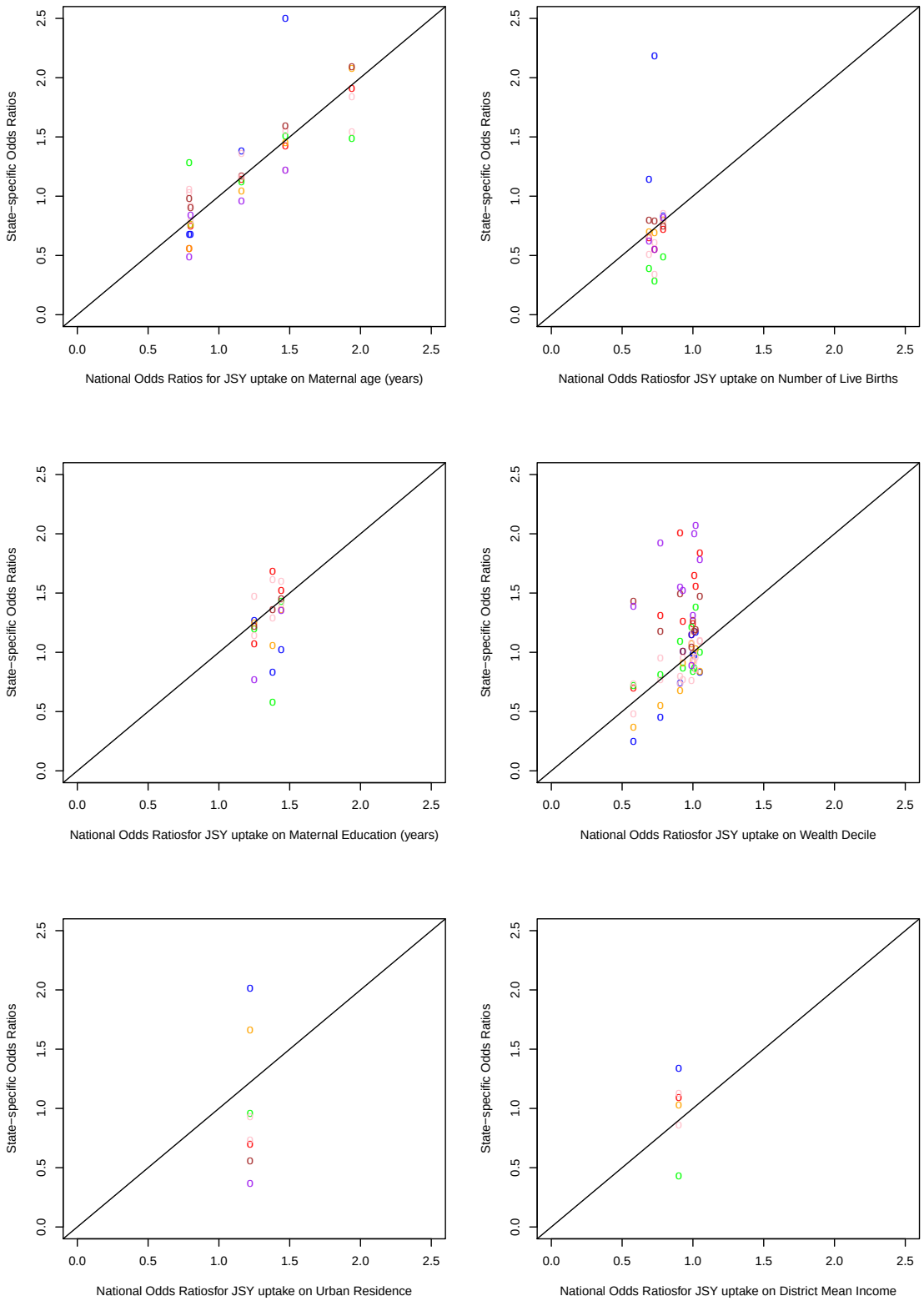

Figure 3 – State-specific Odds Ratios vs National Odds Ratios for characteristics in High Focus States

Impact of Janani Suraksha Yojana

National Level

At the national level, we found that restricting the data to births within the last 12 months of the interview had minimal impact on the estimated treatment effect of JSY on the three health care utilization outcomes (antenatal care, in-facility delivery, skilled birth attendance). The authors' method for measuring the impact of JSY (in Stata) was to hold all covariates at the mean of the indicator variable. Using R to evaluate the impact of JSY on the healthcare utilization outcomes, we found interestingly different results than the method used in Stata. While the parameter coefficients on all covariates remained nearly identical, the treatment effects varied substantially (Table 3). This suggests that the measurement of the impact of JSY on each of these outcomes of interest is highly specific to the method used. We were unable to match the authors' results for the two health outcomes (perinatal and neonatal mortality) and as a result do not base any subsequent weight on these two health outcomes.

	Estimates using R	Estimates using Stata
Antenatal Care	6.0%(5.4−6.6)	10.7%(9.1−12.3)
In-facility birth	47.1%(45.7−48.5)	43.5%(42.5−44.6)
Skilled Birth Attendant	49.7%(48.5−50.9)	36.6%(35.6−37.7)
Perinatal Mortality (per 1000 pregnancies)	-0.043(-0.067−-0.017)	-3.7(-5.2−-2.2)
Neonatal Mortality (per 1000 live births)	-0.062(-0.09−-0.032)	-2.3(-3.7−-0.9)

Table 3 – Differences in estimated treatment effect between R and Stata methods of first differences

State Level

The impact of JSY on health outcomes at the state-level varies greatly across states after performing the analyses using state-specific characteristics of women. For example, Figure 4 shows that for antenatal care visits, the state-specific estimated treatment effects vary from 0 to 28% as compared to the national level estimate of 6.0%, with large degree of uncertainty. The national estimate is shown with vertical blue lines. Some of the uncertainty comes from small sample sizes in the smaller states. Figure 5 shows results for state-specific estimated treatment effects for in-facility birth. Again, we can see that the estimates range from about 0 to 80% as compared to the national level estimated treatment effect of about 47%. These figures show that the state-specific treatment effects are highly variable, and that a national estimate loses a great deal of information that can be obtained.

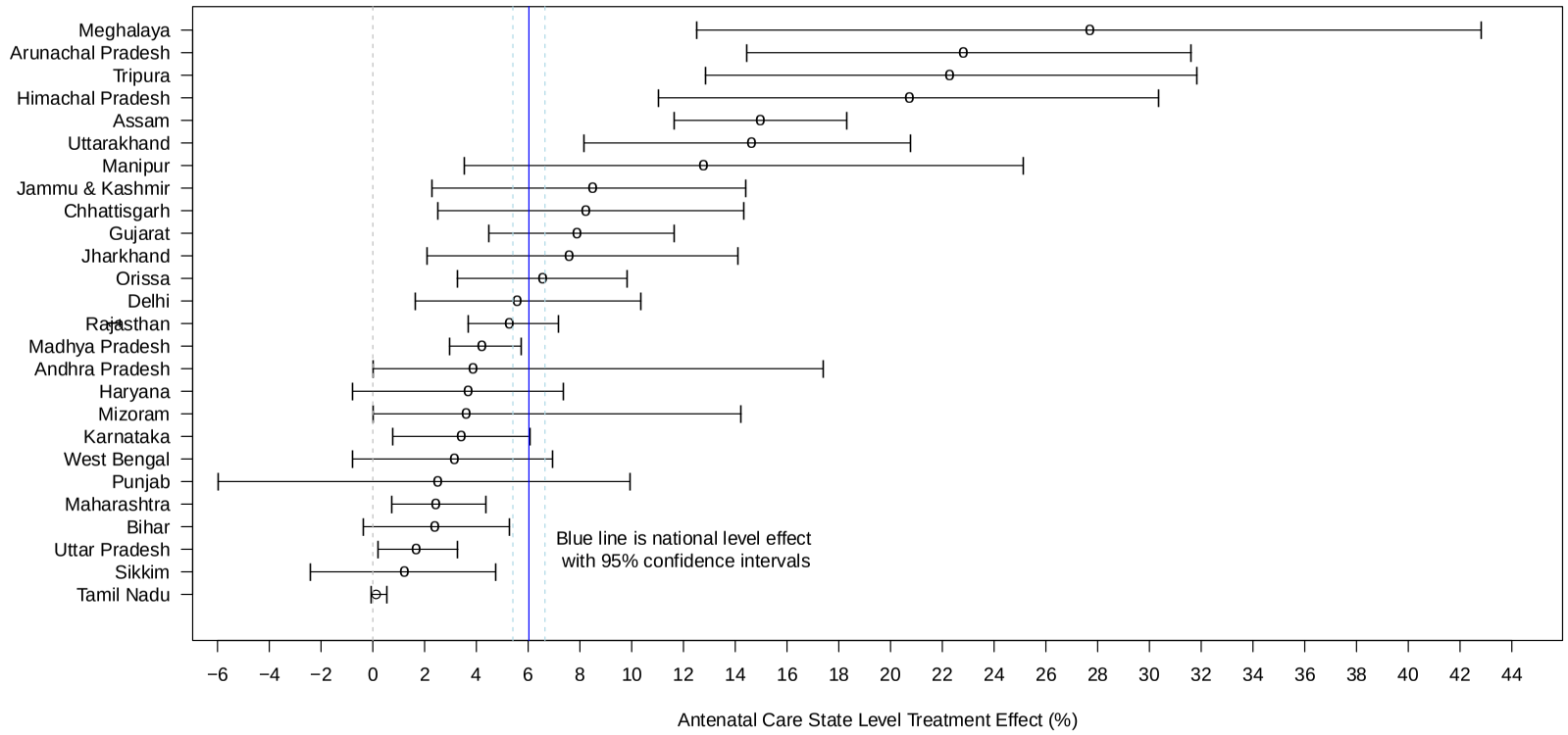

Figure 4 – Estimated JSY treatment effect on antenatal care across states

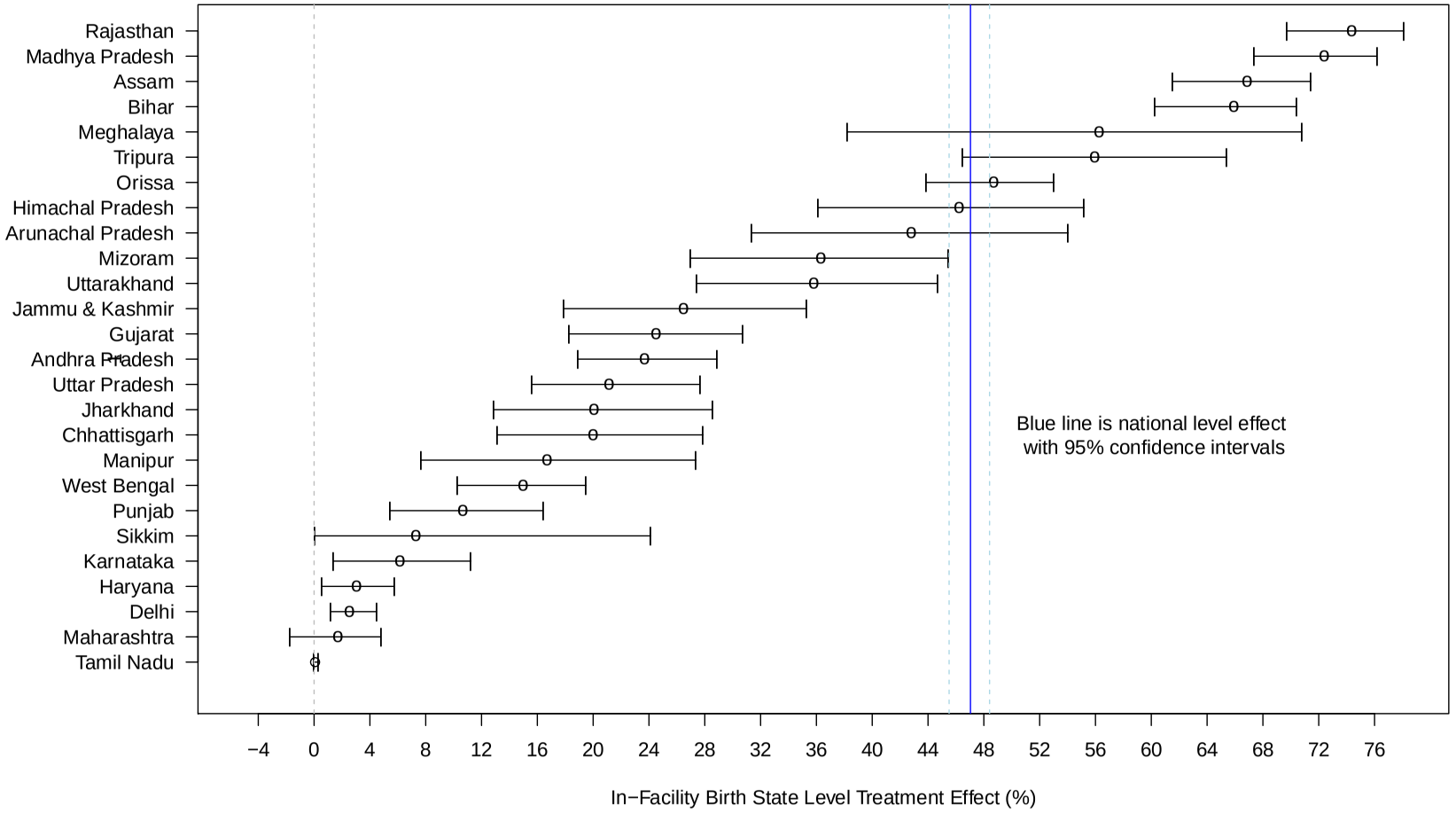

Figure 5 – Estimated JSY treatment effect on in-facility delivery across states

Model Fitting

In order to test our state-specific model fits against the national-level model, we used Receiver-operator characteristic (ROC) curve plots. We computed the percentage of 1's and 0's correctly predicted for difference cut-offs of C where the probability of an observation $\hat{\pi}$ is

$$\hat{\pi} = \frac{1}{1+C}$$

We compared the state-specific model and the national model predictions for the same particular state. Figure 6 shows the ROC curves for six selected states of interest for the health outcome of in-facility birth. We can see that our state-specific model (solid line) dominates the national model predictions for the same state (dotted line) in almost every state. We confirm in this analysis that one limitation of our state-specific models is the sample size. Our state-level model did not predict in-facility births as well as the national model due to a small sample size of 1,058 (as compared to 30,010 for Uttar Pradesh or 10,793 for Rajasthan, for example). The lack of data from one state impacts our ability to make accurate estimates. However, the figure does show that when data exists for states, it is preferential to use state-specific models for health outcome variables over the national level model.

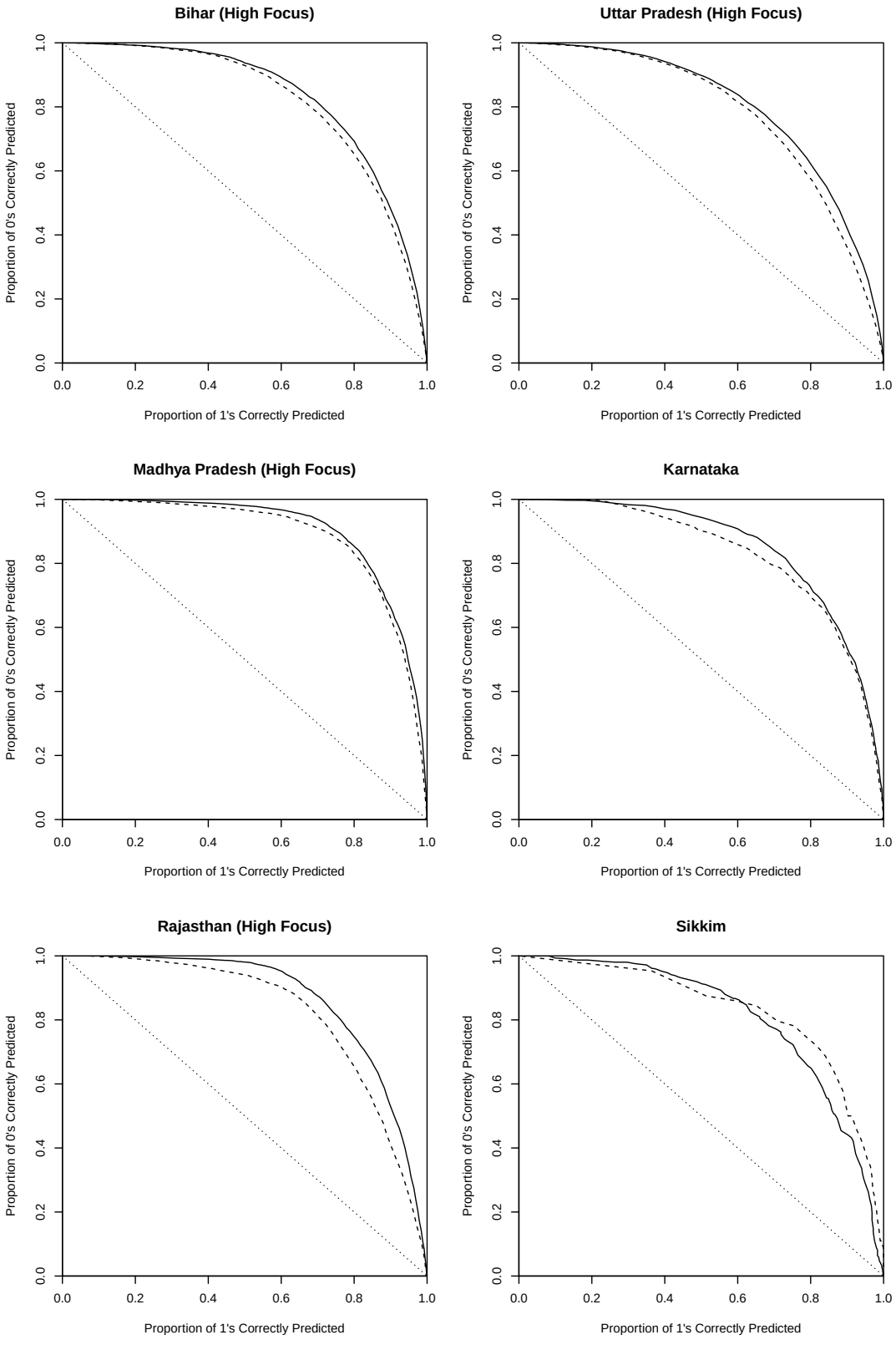

Figure 6 – ROC plots of In-facility births for National model vs State-specific model

Discussion

To be able to improve the uptake of the JSY program and to enhance the impact of JSY on health outcomes, the JSY program should be thoroughly evaluated. Lim (2010) reported a successful impact of JSY on five health outcome using three different methods: exact matching, with versus without analysis and difference in difference analysis. However, none of the methods analyzed the factors determining the uptake of JSY assistance program and the health impact of JSY program at the state-level.

Our study is the first to present and show that (a) the factors determining JSY uptake varied greatly from state to state and (b) the impact of JSY assistance on health outcomes changed significantly from state to state. The difference in JSY uptake for individual characteristics varied between states, and sometimes the group with the highest odds of receiving JSY in one state had the lowest odds in another state. In terms of the difference in impacts of JSY on maternal health outcomes, the state-specific estimates for antenatal care ranged from approximately 0-28% as compared to the national level estimate of 6.0%, and the state-specific estimates for in-facility birth ranged from 0 to 80% as compared to the national level estimated treatment effect of about 47%. We can see that a state-level analysis is necessary to accurately describe the JSY uptake and impact in India.

The method we use to evaluate the impact of JSY on the three healthcare utilization outcomes is more intuitive than the original method used by Lim (2010). In the authors' method, holding covariates at their means implies that the treatment effect is specific to a hypothetical individual that could never exist (for example, 20% Hindu, 15% Muslim, etc). Holding the covariates constant at their mode implies that the treatment effect is the average effect for the most common person in India, across the whole range of covariates. Furthermore, important differences in the measurement of impact are obtained by both methods.

Limited number of observations in some states prevented running analyses at the state-level for every single state. However, based on the ROC plots evaluating model fit, we can see that when data is available the state-specific analysis is the better model. We were unable to replicate the impact of JSY on the two health outcomes (perinatal and neonatal mortality) that Lim (2010) found. While we approximated their outcomes in some of the estimates (odds ratios), the treatment effect varied. Therefore, we focused our analysis on the maternal health outcomes of antenatal care, in-facility birth, and skilled birth attendance in order to make our point the most clear.

Conclusion

Given that the JSY program was not rolled out consistently across states and that states have differing eligibility criteria, it is beneficial to do a state-level analysis. Evaluation of the JSY program at the state-level has three main advantages over evaluation at the national level: (a) it is more accurate in identifying which groups of population should be the focus of the program in order to improve JSY uptake; (b) it could help monitor the progress of the program; and (c) it is more accurate in determining the impact on improvement of maternal health outcomes at the state-level. We find that valuable insight can be gained by evaluating the uptake and impact of JSY at the state-level.

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