Health Systems Challenges for Achieving the Millennium Development Goal for Maternal Health: Selected Indian States

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Abstract

Maternal mortality ratio is alarmingly very high, and appears to have increased in India. The objectives of this study are to identify the association of core individual, household, community and health systems indicators on care during child birth, and to suggest critical policy and program options for accelerating progress towards Millennium Development Goal for maternal health by the selected Indian states including Tamil Nadu, West Bengal, Andhra Pradesh, Bihar, Uttar Pradesh and Rajasthan. Data from National Family Health Surveys are used in this analysis. Multivariate logistic regression analysis results show a strong association of women's education, household wealth, women's ability to take decisions, use of antenatal care and access to health services with the likelihood of delivery by medically trained provider. Study results emphasize the need for appropriate behavior change communication strategies, social safety nets, enhancing core skills of auxiliary nurse midwives and provider incentives to reduce maternal mortality.

Introduction:

To achieve the 5th Millennium Development goal (MDG) targeted to reduce the maternal mortality ratio (MMR) by three-quarters by 2015, is a priority for a country like India where MMR is alarmingly very high, 540 per 1000 live births. Though not statistically significant, maternal mortality ratio appears to have increased from 424 per 100,000 live births in National Family Health Survey (NFHS)-1 to 540 per 100,000 live births in NFHS-2 (NFHS, 1998-99).

However, one strategy may not work for the entire country - a recent study highlights the wide disparity among Indian states and districts and points the urgent need for geographic focus in actions aimed at accelerating progress towards MDGs (World Bank, 2003).

This study employs six major states of India including Tamil Nadu, West Bengal, Andhra Pradesh (AP), Bihar, Uttar Pradesh (UP) and Rajasthan that are in different phases of demographic transition and that contribute half of India's total population. Since maternal mortality is a relatively rare event, we have used the indicator "proportion of births attended by medically trained provider" as a proxy for improving maternal health and to identify the factors associated with care seeking behavior during childbirth. The specific objectives of this study are: 1) to identify the association of core individual, household, community and health systems indicators on care during child birth; and 2) to suggest critical policy and program options for accelerating progress towards Millennium Development Goal for maternal health by the selected major six Indian states.

Materials and Methods:

We used National Family Health Survey (1998-99) data from Andhra Pradesh, Bihar, Rajasthan, Uttar Pradesh, Tamil Nadu and West Bengal in this analysis. The outcome variable ''Care

seeking from medically trained providers during delivery" is modeled as a binary variable. Medically trained providers include physicians, nurse midwives and other health professionals.

The independent variables are divided into three groups including predisposing, enabling and service variables. Predisposing variables include individual characteristics and health beliefs. Woman's age at birth, ethnicity, women's education, parity, birth spacing, partner's education and partner's employment are considered as individual characteristics in this analysis. Woman's health beliefs are centered around how she values existing health services, and whether she thinks preventive health care like seeking antenatal care is important for safe birth reflecting how she values her own health.

Women's empowerment and household wealth index are enabling variables. Women's empowerment is the enabling factor at the individual level while household wealth being the enabling factor at the household level.

Availability and accessibility to the health center are the service variables, which are categorized into public and private facilities to see the differential impact of service accessibility.

Exploratory data analysis is done to see the frequency distributions individual, household and service variables. Multiple logistic regression analysis is used for analyzing care seeking from medically trained providers during delivery. Following model has been used in this analysis.

$$\text{logit}((E(Y_1)) = X_1\beta_1 + H_1\gamma_1 + S_1\delta_1 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad \ldots..(1)$$

Where,

Y_1= Care seeking from medically trained providers during delivery

X1, H1 and S1 = household, community and health systems variables

β_1, γ_1 and δ_1 = associated partial coefficients

In this multiple logistic regression model, the null hypotheses of no association have been examined by looking at the statistical significance of the partial coefficients. The statistical significance of the partial coefficients has been determined by the Wald statistic. Analysis is done using STATA (version 8) statistical software.

Results:

Sample characteristics

About 18 to 34% women of the selected six states of India are young (age group <20). Around 7 to 19% of women are in the age group more than 30. Among the six states, the proportion of young women is highest in Andhra Pradesh, and the proportion of women aged more than 30 is highest in Uttar Pradesh. Over 55 to 92% women of these six states live in the rural area. Around one-fourth to one-third women are from scheduled caste or tribe.

About one-fifth to three-fifth of women are illiterate. Illiteracy rate is highest in Bihar and Rajasthan, and lowest in Tamil Nadu. The proportion of primipara women is highest in Tamil Nadu (35%) and lowest in Uttar Pradesh (20%). Conversely, the proportion of parity 4+ is highest in Uttar Pradesh (42%) and lowest in Tamil Nadu (9%).

Majority of women (28 to 47%) have birth spacing 2-3 years. About 11 to 18% women have birth spacing less than 2 years, and 12 to 20% women have birth spacing more than or equal to 4 years. However, about 22-43% women of this sample from six states are primipara. Over half of the index children are male in all the selected states except for Andhra Pradesh, where the proportion of female children is slightly higher than that of male children.

About 14-44% husbands are illiterate. The proportion is highest in Bihar and lowest in Tamil Nadu. Around 10-25% have primary level, 28-43% have secondary level and 14-20% have higher level of education. Among the six selected states, 35-46% husbands are unemployed. The proportion of unemployment is highest in Tamil Nadu and lowest in Andhra Pradesh.

Women's empowerment is measured by two variables including if woman needed permission to go to the market and if permission was needed to visit relatives or friends. Woman was considered empowered if she did not need permission in either of these two cases. Based on this index, majority (three-fourth) of the women in Tamil Nadu are found to be empowered. The proportion of empowered women is very low (12-20%) in other five states.

Majority (97%) of women in Tamil Nadu state have reported that they visited the nearby health facility because of their own health problems or their children's health problems in last one year. Where as about 15-54% women of other five states visited the health facility in last one year. Of those who recently visited the health facility, majority of women from Tamil Nadu, Andhra Pradesh, Bihar and Uttar Pradesh visited private health facility. Contrarily, the majority of women from West Bengal and Rajasthan visited the public health facility.

About 88-95% women of Tamil Nadu, West Bengal and Andhra Pradesh have reported seeking antenatal care. However, the proportion of antenatal care seeking is relatively lower in Bihar, Uttar Pradesh and Rajasthan (22-36%). Similarly, care seeking from medically trained provider during delivery is higher in Tamil Nadu, West Bengal and Andhra Pradesh (53-86%), and lower in Bihar, Uttar Pradesh and Rajasthan (22-36%).

Household wealth index has been created using 18 variables from the NFHS household questionnaire. The variables include source of drinking water; type of toilet facility; own radio, television, refrigerator, bicycle, motorcycle, car; main source of electricity; number of rooms in dwelling; kitchen as a separate room; main cooking fuel; types of house and own acres of land under cultivation. Principal component analysis is used to create a wealth index (Filmer and Pritchett, 2001). The wealth index has been divided in quintiles. Later, given the distribution of wealth in population, wealth index has been categorized as low (lower 40%), Medium (middle 40%) and high (top 20%). (Filmer and Pritchett, 2001).

Accessibility to health facility has been considered if the health center is located within 5 kilometers from home. Accessibility to both public and private health facilities has been considered. Public health facilities including sub-center, primary health center and govt. health center, where as private hospital as the private health facility have been considered in this analysis. About 72-96% women of the selected states have reported having sub centers in 5 kilometers of their home. About 32-59% have primary health center and 12-20% have govt. hospital with in 5 kilometers of their home. About 17-41% of women of the selected states have reported to have private hospitals with in their access (5 kilometers from home) (Table 1).

Findings from multiple logistic regression analysis

Results from multiple logistic regression analysis show that household, social and economic variables and health systems access are strongly associated with the type of medical attention received during childbirth.

Across all states studied, “women’s education” and “household wealth” have shown strongest association with skilled care during childbirth. Secondary or higher level education has much stronger association with seeking care from medically trained providers. In the selected six states, women having primary level education are 1.2-1.6 times more likely to seek delivery care from skilled providers compared to women having no education. Compared to women with no education, women with secondary or higher level of education are 1.7-2.7 times more likely to seek delivery care from medically trained providers (Table 2-7).

In all six states, household resources appeared to be another strong determinant in care seeking during childbirth. In the selected states excluding Tamil Nadu, compared to women having low household resources, women having medium household resources are 1.4-1.8 times, and women having higher household resources are 2.5-3.5 times more likely to seek delivery care from medically trained providers (Table 2-5 and Table7). The magnitude of association is the strongest in Tamil Nadu (OR=2.4 and OR=7.7 respectively, Table 6).

Women who received antenatal care are more likely to seek care by a trained provider in AP, Bihar, UP and Rajasthan (OR=4.4, OR=2.5, OR=3.3, OR=3.1 respectively; Table1-4). In these states, women having more autonomy in making decisions at household level are more likely to seek trained medical care during childbirth except for Bihar. No such association was observed in Tamil Nadu and West Bengal.

In four states (Bihar, Rajasthan, Tamil Nadu, West Bengal), access to health services has shown strong association with likelihood of delivery by medically trained provider. Among these states health sub-center had such impact only in Tamil Nadu (OR=2.38), while it was public hospitals in case of West Bengal (OR=2.53), Primary Health Centers in Rajasthan (OR=1.65) and Private hospitals in Bihar (OR=1.67).

Among other factors, ethnicity has come out as a significant determinant in Tamil Nadu. Compared to women with no ethnicity, schedule caste/tribe women are 48 percent less likely to seek delivery care from medically trained providers. Recent visit to health centers is also a strong determinant for seeking delivery care from medically trained provider in Tamil Nadu, West Bengal, Bihar, Uttar Pradesh and Rajasthan. Parity appears to be significantly associated with care seeking during childbirth in West Bengal and Uttar Pradesh. Compared to para 1 women, para 2 women are 60 percent, para 3 women are 70 percent and para 4+ women are 80 percent less likely to seek delivery care from medically trained providers in West Bengal (Table 7). Similarly in Uttar Pradesh, Compared to para 1 women, para 2 women are 40 percent, para 3 women are 58 percent and para 4+ women are 56 percent less likely to seek delivery care from skilled providers (Table 4). Birth spacing is a significant determinant in Rajasthan, West Bengal and Andhra Pradesh (Table 5, 7, 2).

Discussion:

Household, social and economic variables and health systems access have much stronger association with the type of medical attention received during child birth. Across all states studied, women's education and household wealth have strongest association with decision-making for the provider used in childbirth. In four out of the six states studied (AP, Bihar, Rajasthan and UP), women's ability to take decisions in family and use of antenatal care have strong association with choice of attendant at delivery. These findings suggest that care seeking for women is much more influenced by deep routed socio-economic factors. Empowerment helps woman make decision in seeking care for her own health (Nanda, 1999).

In shorter term there is need to focus on efforts to increase demand for maternal health services through appropriate behavior change communication strategies. However, this cannot be a substitute for women's education for overall success of the program as well as sustainable improvement of the outcome in the long run (Ahmed, 1996).

In this research wealth index has been created considering 18 household possession variables from NFHS questionnaire. The wealth index has been divided in quintiles. Later, given the distribution of wealth in population, wealth index has been categorized as low (lower 40%), Medium (middle 40%) and high (top 20%). Across the selected Indian states, household wealth is found to have a very strong determinant for delivery care seeking. This finding is supported by the findings of the study by Kunst and Houweling. In their analysis, Kunst and Houweling found a huge gap between uppermost richest quintile and the rest of the population of Bangladesh in delivery attendance by medically trained providers. In Bangladesh, about 30% deliveries are conducted by skilled attendants in highest quintiles, and less than 10% deliveries are being conducted by skilled attendants for each of the lower quintiles (Kunst and Houweling, 2001).

In this research, in all the selected states, significant difference is found between women with higher household resources and women with lower household resources in case of delivery care

seeking from medically trained providers. This important finding warrants targeting poor women for utilizing maternal health care services. Wealth inequalities in use of delivery services highlight the importance of social safety nets for improving access to safe delivery services for poor women. This requires new ways of financing maternal health services such as conditional cash transfers, service delivery contracts with private sector etc.

In four states (Bihar, Rajasthan, Tamil Nadu, West Bengal), access to health services has shown strong association with likelihood of delivery by medically trained provider. Study results show a positive association between service accessibility and women's care seeking. Women those live in 5 kilometers of the health center in Tamil Nadu, West Bengal, Rajasthan and Bihar, are more likely to seek delivery care. Among these states health sub center had such impact only in Tamil Nadu while it was public hospitals in case of West Bengal, Primary Health Centers in Rajasthan and Private hospitals in Bihar. Conscious strategy adopted by Tamil Nadu to encourage Village Health Nurses to conduct deliveries seems to create demand for skilled care during child birth. Two studies conducted by Fauveau et al (Fauveau et al, 1991) and Ronsmans et al (Ronsmans et al, 1997) in rural Bangladesh show results that support this study findings.

Service accessibility significantly increases the likelihood of delivery by medically trained provider. Study results emphasize the need to focus on efforts to increase demand for maternal health services through appropriate behavior change communication strategies, social safety nets for improving access to safe delivery services for the poor women, enhancing core skills of auxiliary nurse midwives in managing third stage of labor and provider incentives for conducting deliveries.

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Table1: Sample characteristics of married women and of their index children

Characteristics	**Tamil Nadu**		**West Bengal**		**Andhra Pradesh**		**Bihar**		**Uttar Pradesh**		**Rajasthan**	
	%	N	%	N	%	N	%	N	%	N	%	N
Individual characteristics:												
Women's age at birth												
<20	18.4	247	25.3	310	34.1	385	22.2	655	21.5	930	20.1	614
20-24	47.2	635	39.1	479	42.0	474	35.1	1035	34.9	1511	39.5	1207
25-29	26.8	360	24.0	294	17.1	193	25.1	739	24.4	1055	23.5	717
30+	7.7	103	11.5	141	6.9	78	17.6	519	19.2	828	16.9	516
Place of residence												
Urban	44.4	597	35.5	435	26.6	301	8.3	245	16.1	694	19.6	599
Rural	55.6	748	64.5	789	73.4	829	91.7	2703	84.0	3630	80.4	2455
Ethnicity												
Scheduled caste	24.3	327	23.2	284	21.3	241	22.7	670	20.9	902	19.5	596
Scheduled tribe	0.7	9	5.7	70	5.8	66	6.3	187	2.5	107	16.0	490
Other backward caste	72.8	979	4.1	50	44.1	498	52.8	1557	26.7	1156	22.8	697
None of them	2.2	30	67.0	820	28.8	325	18.1	534	49.9	2159	41.6	1271
Education of wife												
None	22.6	304	40.5	496	48.2	545	76.4	2251	67.9	2937	76.1	2325
Primary	27.1	364	23.6	289	17.8	201	5.8	170	13.4	578	10.6	323
Secondary	37.0	497	27.9	341	26.6	301	14.9	438	18.7	529	9.7	297
Higher	13.4	180	8.0	98	7.4	83	3.0	89	0.0	280	3.6	109
Parity												
1	34.9	470	33.7	413	29.6	334	20.0	590	17.8	770	19.7	603
2	40.5	545	30.2	369	36.7	415	22.8	672	21.2	915	24.6	752
3	15.3	206	17.2	210	16.9	191	18.3	539	19.3	835	19.2	587
4+	9.2	124	19.0	232	16.8	190	38.9	1147	41.7	1804	36.4	1112
Birth order												
1	43.1	580	37.3	457	36.3	410	23.2	685	21.7	936	24.7	754
2	35.2	473	28.8	352	32.4	366	22.2	654	20.5	885	22.8	695
3	13.5	182	15.7	192	16.4	185	17.3	509	18.3	791	18.0	549
4+	8.2	110	18.2	223	15.0	169	37.3	1100	39.6	1712	34.6	1056
Birth spacing (rural)												
< 2 years	17.0	228	11.7	143	13.6	154	14.0	413	17.6	760	18.4	561
2-3 years	28.2	379	31.1	380	35.6	402	42.8	1263	44.6	1928	43.8	1338
4+ years	11.6	156	19.6	240	14.4	163	19.7	582	15.9	689	13.1	399
Primipara	43.3	582	37.7	461	36.4	411	23.4	690	21.9	947	24.8	756
Sex of the child												
Male	52.5	706	53.2	651	49.4	558	51.7	1523	52.0	2249	52.2	1594
Female	47.5	639	46.8	573	50.6	572	48.3	1425	48.0	2075	47.8	1460
Total	**100.0**	**748**	**100.0**	**789**	**100.0**	**829**	**100.0**	**2703**	**100.0**	**3630**	**100.0**	**2455**

Husband's education												
No education	13.7	184	27.5	333	35.0	396	44.2	1302	28.2	1217	33.3	1017
Primary	24.2	326	25.3	306	16.4	185	10.4	305	15.6	675	16.0	487
Secondary	43.1	579	34.1	412	28.4	321	30.5	899	36.7	1586	35.6	1088
Higher	19.0	256	14.3	173	20.2	228	15.0	442	19.6	846	15.1	462
Husband's employment												
No	45.9	617	38.2	467	35.0	395	38.1	1123	40.7	1758	42.9	1310
Yes	54.1	728	61.9	757	65.0	735	61.9	1825	59.3	2566	57.1	1744
Women's empowerment												
No	25.0	336	87.8	1074	80.1	905	81.7	2408	87.0	3760	85.3	2606
Yes	75.0	1009	12.3	150	19.9	225	18.3	540	13.0	564	14.7	448
Recent visit (in I yr) to health center												
None	3.4	45	18.7	229	15.0	169	49.1	1446	45.0	1944	53.6	1638
Public	38.4	516	49.0	600	17.4	196	17.1	505	19.5	841	35.4	1080
Private	58.3	784	32.3	395	67.7	765	33.8	997	35.6	1539	11.0	336
Antenatal care seeking												
No	4.9	66	11.0	134	11.9	134	63.9	1885	65.4	2827	51.8	1583
Yes	95.1	1273	89.1	1090	88.1	996	36.1	1063	34.6	1497	48.2	1471
Care seeking from medically trained providers during delivery												
No	14.1	189	46.9	574	34.2	386	76.8	2264	77.4	3348	63.9	1951
Yes	86.0	1156	53.1	650	65.8	744	23.2	684	22.6	976	36.1	1103
Household characteristics:												
Wealth index												
Low	41.0	551	52.3	640	37.2	420	37.7	1112	39.5	1709	42.4	1296
Medium	41.1	553	34.6	424	42.0	475	42.8	1262	45.0	1944	42.4	1296
High	17.9	241	13.1	160	20.8	235	19.5	574	15.5	671	15.1	462
Service characteristics:												
Accessibility to heath center (with in 5 km from home)												
Sub-center												
No	9.6	72	4.1	32	17.3	143	22.4	604	28.2	1024	12.6	310
Yes	90.4	676	95.9	757	82.8	686	77.7	2099	71.8	2606	87.4	2145
Primary health center												
No	49.9	373	41.3	326	44.2	366	43.2	1168	53.9	1958	67.7	1662
Yes	50.1	375	58.7	463	55.9	463	56.8	1535	46.1	1672	32.3	793
Govt. Hospital												
No	82.6	618	86.6	683	83.1	689	80.1	2164	86.1	3125	87.7	2153
Yes	17.4	130	13.4	106	16.9	140	19.9	539	13.9	505	12.3	302
Private hospital												
No	59.0	441	77.1	608	68.5	568	75.7	2045	78.3	2841	83.3	2045
Yes	41.0	307	22.9	181	31.5	261	24.3	658	21.7	789	16.7	410
Total	**100.0**	**748**	**100.0**	**789**	**100.0**	**829**	**100.0**	**2703**	**100.0**	**3630**	**100.0**	**2455**

Table 2: Multiple logistic regression analysis estimates for determinants of care seeking from medically trained providers during delivery, Andhra Pradesh, India (ref period: 3 years preceding the survey, N=829)

Characteristics	Odds Ratio	SE	Z	P-Value	95% CI	
Predisposing variables:						
Individual characteristics						
Ethnicity (None)						
Scheduled caste/tribe	1.00	0.23	0.01	0.99	0.64	1.57
Other backward caste	1.26	0.27	1.08	0.28	0.83	1.94
Women's education (ref: No education)						
Primary	1.69	0.35	2.51	**0.01**	1.12	2.54
Secondary+	2.94	0.70	4.52	**0.00**	1.84	4.69
Parity (ref: Parity 1)						
2	0.95	0.37	-0.13	0.90	0.44	2.04
3	1.13	0.51	0.26	0.79	0.46	2.73
4+	1.04	0.47	0.09	0.93	0.43	2.54
Birth spacing (ref: 2-3 yrs)						
<2 years	1.11	0.28	0.40	0.69	0.67	1.83
4+ years	1.15	0.27	0.59	0.56	0.73	1.81
Primipara	2.21	0.87	2.02	**0.04**	1.02	4.77
Partner's employment (ref: No)	0.94	0.17	-0.32	0.75	0.66	1.34
Service utilization (health beliefs)						
Recent visit to health center (ref: No)						
Public	1.07	0.29	0.27	0.79	0.63	1.82
Private	1.41	0.31	1.56	0.12	0.91	2.19
Antenatal care (ref: No)	4.38	1.45	4.46	**0.00**	2.29	8.37
Enabling variables:						
Women's empowerment (ref: No)	1.97	0.42	3.15	**0.00**	1.29	3.00
Household wealth index* (ref: Low)						
Middle	1.53	0.26	2.51	**0.01**	1.10	2.13
High	3.53	1.52	2.93	**0.00**	1.52	8.21
Service variables:						
Accessibility to health center (ref: Distance > 5 km)						
Public facility						
Sub-center	0.86	0.19	-0.71	0.48	0.56	1.32
Primary health center	1.17	0.22	0.83	0.41	0.81	1.69
Govt. hospital	0.86	0.20	-0.62	0.53	0.55	1.37
Private facility						
Private hospital	1.13	0.22	0.61	0.54	0.77	1.66

Table 3: Multiple logistic regression analysis estimates for determinants of care seeking from medically trained providers during delivery, Bihar, India (ref period: 3 years preceding the survey, N=2703)

Characteristics	Odds Ratio	SE	Z	P-Value	95% CI	
Predisposing variables:						
Individual characteristics						
Ethnicity (None)						
Scheduled caste/tribe	0.80	0.14	-1.29	0.20	0.57	1.12
Other backward caste	0.83	0.12	-1.26	0.21	0.63	1.11
Women's education (ref: No education)						
Primary	0.93	0.21	-0.32	0.75	0.59	1.46
Secondary+	2.12	0.31	5.08	**0.00**	1.59	2.84
Parity (ref: Parity 1)						
2	0.67	0.20	-1.37	0.17	0.38	1.19
3	0.68	0.23	-1.14	0.26	0.35	1.32
4+	0.54	0.18	-1.87	0.06	0.28	1.03
Birth spacing (ref: 2-3 yrs)						
<2 years	1.07	0.18	0.43	0.67	0.77	1.49
4+ years	0.89	0.15	-0.70	0.48	0.65	1.23
Primipara	1.21	0.36	0.64	0.53	0.67	2.18
Partner's employment (ref: No)	0.92	0.11	-0.71	0.48	0.74	1.15
Service utilization (health beliefs)						
Recent visit to health center (ref: No)						
Public	1.94	0.30	4.36	**0.00**	1.44	2.62
Private	1.71	0.22	4.24	**0.00**	1.33	2.19
Antenatal care (ref: No)	2.48	0.29	7.87	**0.00**	1.98	3.11
Enabling variables:						
Women's empowerment (ref: No)	0.66	0.11	-2.51	**0.01**	0.48	0.91
Household wealth index* (ref: Low)						
Middle	1.70	0.23	3.88	**0.00**	1.30	2.23
High	3.92	0.69	7.75	**0.00**	2.77	5.53
Service variables:						
Accessibility to health center (ref: Distance > 5 km)						
Public facility						
Sub-center	1.03	0.17	0.16	0.88	0.74	1.41
Primary health center	1.24	0.17	1.55	0.12	0.94	1.64
Govt. hospital	0.98	0.17	-0.11	0.91	0.71	1.37
Private facility						
Private hospital	1.67	0.26	3.31	**0.00**	1.23	2.27

Table 4: Multiple logistic regression analysis estimates for determinants of care seeking from medically trained providers during delivery, Uttar Pradesh, India (ref period: 3 years preceding the survey, N=3630)

Characteristics	Odds Ratio	SE	Z	P-Value	95% CI	
Predisposing variables:						
Individual characteristics						
Ethnicity (None)						
Scheduled caste/tribe	1.04	0.13	0.29	0.77	0.81	1.33
Other backward caste	0.95	0.11	-0.42	0.68	0.75	1.20
Women's education (ref: No education)						
Primary	1.44	0.20	2.68	**0.01**	1.10	1.88
Secondary+	1.98	0.27	5.09	**0.00**	1.52	2.58
Parity (ref: Parity 1)						
2	0.61	0.15	-2.08	**0.04**	0.38	0.97
3	0.42	0.12	-3.02	**0.00**	0.24	0.74
4+	0.44	0.12	-2.97	**0.00**	0.26	0.76
Birth spacing (ref: 2-3 yrs)						
<2 years	0.90	0.13	-0.71	0.48	0.67	1.20
4+ years	1.30	0.19	1.78	0.08	0.97	1.73
Primipara	1.11	0.28	0.41	0.68	0.68	1.81
Partner's employment (ref: No)	0.91	0.09	-0.89	0.37	0.75	1.11
Service utilization (health beliefs)						
Recent visit to health center (ref: No)						
Public	1.33	0.17	2.24	**0.03**	1.04	1.71
Private	1.11	0.13	0.89	0.38	0.89	1.38
Antenatal care (ref: No)	3.31	0.34	11.80	**0.00**	2.71	4.04
Enabling variables:						
Women's empowerment (ref: No)	1.34	0.20	1.99	**0.05**	1.00	1.80
Household wealth index* (ref: Low)						
Middle	1.62	0.18	4.40	**0.00**	1.31	2.01
High	3.22	0.58	6.55	**0.00**	2.27	4.58
Service variables:						
Accessibility to health center (ref: Distance > 5 km)						
Public facility						
Sub-center	1.18	0.14	1.37	0.17	0.93	1.49
Primary health center	1.17	0.13	1.46	0.14	0.95	1.46
Govt. hospital	0.84	0.15	-0.98	0.33	0.60	1.19
Private facility						
Private hospital	1.07	0.15	0.45	0.65	0.80	1.42

Table 5: Multiple logistic regression analysis estimates for determinants of care seeking from medically trained providers during delivery, Rajasthan, India (ref period: 3 years preceding the survey, N=2459)

Characteristics	Odds Ratio	SE	Z	P-Value	95% CI	
Predisposing variables:						
Individual characteristics						
Ethnicity (None)						
Scheduled caste/tribe	0.91	0.11	-0.78	0.44	0.72	1.15
Other backward caste	1.23	0.16	1.61	0.11	0.96	1.59
Women's education (ref: No education)						
Primary	1.50	0.24	2.47	**0.01**	1.09	2.06
Secondary+	1.69	0.32	2.78	**0.01**	1.17	2.46
Parity (ref: Parity 1)						
2	0.78	0.19	-1.02	0.31	0.49	1.25
3	0.77	0.22	-0.91	0.36	0.44	1.35
4+	0.75	0.21	-1.06	0.29	0.43	1.28
Birth spacing (ref: 2-3 yrs)						
<2 years	0.98	0.14	-0.15	0.88	0.74	1.29
4+ years	1.60	0.25	3.01	**0.00**	1.18	2.18
Primipara	1.98	0.49	2.79	**0.01**	1.23	3.21
Partner's employment (ref: No)	1.04	0.11	0.35	0.72	0.85	1.27
Service utilization (health beliefs)						
Recent visit to health center (ref: No)						
Public	1.67	0.18	4.73	**0.00**	1.35	2.07
Private	1.96	0.32	4.09	**0.00**	1.42	2.71
Antenatal care (ref: No)	3.09	0.32	10.92	**0.00**	2.53	3.79
Enabling variables:						
Women's empowerment (ref: No)	1.39	0.20	2.30	**0.02**	1.05	1.85
Household wealth index* (ref: Low)						
Middle	1.39	0.15	3.04	**0.00**	1.12	1.72
High	3.38	0.81	5.10	**0.00**	2.12	5.40
Service variables:						
Accessibility to health center (ref: Distance > 5 km)						
Public facility						
Sub-center	1.04	0.16	0.24	0.81	0.77	1.41
Primary health center	1.65	0.19	4.39	**0.00**	1.32	2.06
Govt. hospital	1.01	0.16	0.05	0.96	0.74	1.38
Private facility						
Private hospital	1.65	0.23	3.66	**0.00**	1.26	2.16

Table 6: Multiple logistic regression ana lysis estimates for determinants of care seeking from medically trained providers during delivery, Tamil Nadu, India (ref period: 3 years preceding the survey, N=748)

Characteristics	Odds Ratio	SE	Z	P-Value	95% CI	
Predisposing variables:						
Individual characteristics						
Ethnicity (None)						
Scheduled caste/tribe	0.52	0.11	-3.03	**0.00**	0.34	0.79
Women's education (ref: No education)						
Primary	1.64	0.39	2.05	**0.04**	1.02	2.63
Secondary+	2.66	0.71	3.68	**0.00**	1.58	4.48
Parity (ref: Parity 1)						
2	1.41	0.76	0.64	0.52	0.49	4.05
3	1.12	0.68	0.18	0.86	0.34	3.68
4+	0.97	0.60	-0.05	0.96	0.29	3.23
Birth spacing (ref: 2-3 yrs)						
<2 years	1.11	0.31	0.38	0.70	0.65	1.92
4+ years	1.83	0.61	1.80	0.07	0.95	3.54
Primipara	3.51	1.89	2.33	**0.02**	1.22	10.10
Partner's employment (ref: No)	1.06	0.23	0.28	0.78	0.70	1.62
Service utilization (health beliefs)						
Recent visit to health center (ref: No)						
Public	5.79	2.61	3.90	**0.00**	2.40	13.99
Private	4.77	2.12	3.52	**0.00**	2.00	11.38
Antenatal care (ref: No)	2.27	1.44	1.29	0.20	0.65	7.86
Enabling variables:						
Women's empowerment (ref: No)	0.80	0.20	-0.92	0.36	0.49	1.29
Household wealth index* (ref: Low)						
Middle	2.42	0.62	3.44	**0.00**	1.46	4.00
High	7.70	8.12	1.93	**0.05**	0.97	60.89
Service variables:						
Accessibility to health center (ref: Distance > 5 km)						
Public facility						
Sub-center	2.38	0.74	2.79	**0.01**	1.29	4.38
Primary health center	0.87	0.18	-0.67	0.50	0.58	1.30
Govt. hospital	1.80	0.63	1.69	0.09	0.91	3.57
Private facility						
Private hospital	1.02	0.25	0.09	0.93	0.64	1.64

Table 7: Multiple logistic regression analysis estimates for determinants of care seeking from medically trained providers during delivery, West Bengal, India (ref period: 3 years preceding the survey, N=789)

Characteristics	Odds Ratio	SE	Z	P-Value	95% CI	
Predisposing variables:						
Individual characteristics						
Ethnicity (None)						
Scheduled caste/tribe	1.28	0.24	1.31	0.19	0.89	1.84
Other backward caste	2.39	1.27	1.64	0.10	0.85	6.75
Women's education (ref: No education)						
Primary	1.21	0.25	0.93	0.35	0.81	1.83
Secondary+	2.34	0.54	3.64	**0.00**	1.48	3.69
Parity (ref: Parity 1)						
2	0.42	0.18	-2.01	**0.05**	0.18	0.98
3	0.32	0.16	-2.26	**0.02**	0.12	0.86
4+	0.18	0.09	-3.34	**0.00**	0.06	0.49
Birth spacing (ref: 2-3 yrs)						
<2 years	0.46	0.16	-2.28	**0.02**	0.24	0.90
4+ years	1.11	0.27	0.43	0.67	0.69	1.79
Primipara	1.23	0.56	0.46	0.64	0.51	3.00
Partner's employment (ref: No)	0.99	0.18	-0.06	0.95	0.69	1.42
Service utilization (health beliefs)						
Recent visit to health center (ref: No)						
Public	1.68	0.40	2.20	**0.03**	1.06	2.68
Private	1.02	0.27	0.06	0.95	0.61	1.70
Antenatal care (ref: No)	1.25	0.39	0.71	0.48	0.68	2.29
Enabling variables:						
Women's empowerment (ref: No)	0.92	0.30	-0.25	0.81	0.49	1.75
Household wealth index* (ref: Low)						
Middle	1.80	0.39	2.72	**0.01**	1.18	2.75
High	2.46	1.10	2.00	**0.05**	1.02	5.93
Service variables:						
Accessibility to health center (ref: Distance > 5 km)						
Public facility						
Sub-center	0.87	0.38	-0.31	0.75	0.37	2.07
Primary health center	0.89	0.16	-0.64	0.52	0.62	1.27
Govt. hospital	2.53	0.68	3.47	**0.00**	1.50	4.27
Private facility						
Private hospital	0.80	0.18	-1.01	0.31	0.52	1.23

Table 8: Comparison of determinants of care seeking from medically trained providers during delivery among selected six Indian states

Factors associated with Skilled Attendance at Birth							
Level	**Indicators**	**States**					
		Tamil Nadu	**West Bengal**	**Andhra Pradesh**	**Bihar**	**Uttar Pradesh**	**Rajasthan**
Household	Women's education	1	1	1	1	1	1
	Parity		1		3	1	
	Spacing	3	2	2		3	1
	Partner's employment						
	Recent visit to health center	1	2		1	2	1
	ANC			1	1	1	1
	Women's empowerment			1	1	2	2
	Wealth index	1	1	1	1	1	1
Community	Ethnicity	1					
Health Systems	Sub center	2					
	Primary health center						1
	Govt. hospital		1				
	Private hospital				1		1
	N	748	789	829	2703	3630	2459

Significant at $p < 0.001$	1
Significant at $p < 0.05$	2
Significant at $p < 0.1$	3

Figure 1: Map of India showing selected states