Assessment of differentials of risk factors for full antenatal care and complete immunisation coverage between rural and urban population of India - A multilevel modelling approach

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Abstract

Background: India, is one of the key contributors in both maternal and child death globally with notable gap between rural and urban across the country. Large scale surveys likeNational Family Health Survey (NFHS) follow hierarchical characters in which subjects within the clustersare often correlated. Individual level analysis to identify the predictors of an outcome ignores within the cluster variability; while multilevel model incorporates it. The present analysis was to identify the predictor of full ANC and complete immunisation separately for rural and urban as well as differentials between them by using multilevel logistic model for Indian population.
Methodology: The data on women age 15-49 years given birth in last five years and children of age 12-23 months obtained from India's (NFHS-IV) was considered. The estimates of effect size of the predictors for full ANC and complete immunisation by using multilevel logistic modelswere assessed separately for rural and urban and thereafter, difference between rural and urban in odds ratio (OR) for each category of predictors was compared.
Results: Each selected predictor was found significant for any of the categories. However, some predictor's categories like age that show significant effect size in rural did not emerge in urban.For both outcomes, the most important were women's education, child birth order, wealth quintile. Education and wealth quintile were positively associated with the outcome; while negatively with child birth order. Rural urban difference emerged to be significant in caste categories for both full ANC ($p = 0.047$ & $p = 0.001$ for OBC and other caste) and full immunisation ($p = 0.044$& $p = 0.048$ for OBC and other caste); while wealth quintile only for full ANC ($p = 0.029$, 0.002 &< 0.001 for middle, richer and richest) with low OR.
Conclusion: In addition to poor education and mothers progressing to higher order births, caste group and wealth quintile groups should be the focused to women specially living in rural areas.

Key words: Hierarchical data, Maternal and child health, Odds ratio, NFHS-IV.
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Introduction:

Maternal and child health is amajor challenge to the health-care system, especially in developing nations with higher total fertility rates.Antenatal care (ANC) and immunization of new born under Maternal and Child Care (MCH) services provides the opportunity to promote a positive pregnancy with improved maternaland child survival.[1-3]

Globally, India is one of the key contributors for both maternal and child death. More than 100 maternal deaths per 100,000 live births occur each year of which major portionare from rural. Similarly, out of over 23.7 neonatal death per 1000 live births each year, 29 deaths are from rural and 15 deathsfrom urban.[4-6]This existing disparity between rural and urban could be caused because of existence of disparity in utilization of MCH services. This could be seen as only 32.8% of rural mothers had full ANC visits against 50.1% of urban. While complete immunization was 60.5% in rural against 64.9% in urban.[7]

The underlying responsible factors for lesser utilization of MCH services by rural women could be attributed to poor literacy resulting to poor awareness, poor economic condition, less importanceand less access of health facilities than the urban.Among the reproductive age group women, about two thirdlive in rural areas and illiterates are almost twice (21.2%) than that of urban (10.3%). [8] As per National Family Health Survey-IV (NFHS-IV), 15.1% urban married women are of age 15-25 years; while such women in rural are 1.5 times(21.8%). Although, in the age group 35-49 years, urban women are more (46.0%) thanrural (41.0); but more rural women than urban continue the reproduction process.[9]

Thus, due consideration is required to thetwo third rural population while policy formulation. For the effective framing of policy, the separate analysis of rural and urban for the predictors of full ANC and complete child immunization need to be addressed. The nationalrepresentativelarge data setsare usually collected under cluster designs, which are hieratical in nature i.e., data have inherent property between the groups and within the groups and may be correlated. For instance, NFHS data set which was used in this paper had shown hieratical structure for both rural and urban. The variance partition coefficient (VPC) being an indicator of intra-class variability for full ANC at district and state levels were 7.11% and 24.05% in rural; while in urban these VPC were 7.78% and 14.62%. And the VPC for complete immunization at district and state levels were 7.5% and 12.19% in rural as against 4.96% and 9.13% in urban.

Therefore, the studies pointing out the predictors of different components of MCH services by using ordinary logistic regression, where in the intra class variability ignored,maynot be robustfor precise estimates of the predictors and may be spurious some-times also.[10-13]Multilevel modelling, a statistical techniquewhich is an extension of ordinary logistic regression method incorporates the existence of intra class variability within the clusters.Thus, the ordinary regression technique that disaggregates all data to the lowest level with the assumption of independence is not capable to provide robust estimates of the predictors. [14,15]

Therefore, the present analysiswas carried for full ANC and complete immunisation coverage applying multilevel logistic regression method. The objective was to assess the predictors of full ANC and complete immunization separately for rural and urban and further, the differentials of risk factors between rural and urban population by using India's NFHS-IV data.

Materials and methods:

The data description:

The data used was fourth round of India's National Family Health Survey (NFHS-IV). 179622 women aged 15-49 and given birth within last 5 years and 44117 children age 12-23 months for whom information were complete. NFHS-IV was nationally represented survey conducted in 2015-16 by International Institute for Population Sciences (IIPS) under the direction of the Ministry of Health and Family Welfare (MoHFW),

Government of India (GOI). It covered all 29 states and seven union territories and provided estimates for the first time at district level also. Detailed respondent's selection procedure is described in report of NFHS-IV [9]. The survey was approved by the International Institute for Population Sciences (IIPS) ethical review board in India and the institutional review boards of the funding agencies and the technical assistance agencies.[7]

Outcome variable:

The outcome variable for the present study was the full ANC and full immunisation. Full ANC i.e., mother had ≥ 4 antenatal visits,had least one tetanus toxoid (TT) injection and consumed iron folic acid (IFA) tablets or syrup for a minimum of 100 days. While criteria for complete Immunisation was children aged 12–23 months had received one dose each of Bacillus Calmette–Guérin (BCG) and measles, and three doses each of diphtheria, pertussis and tetanus (DPT) and polio vaccine.[9]Both the outcome variables were dichotomous in nature.

Predictor variables:

The common predictor variables for both full ANC and complete immunization includedwere current age of women (15-19, 20-34, 35-49), women's education (no education, primary, secondary, higher), child birth order (1st, 2nd or 3rd, 4th or 5th, ≥6), religion (Hindu, Muslim, others), caste (SC/ST, OBC, others), wealth quintile (poorest, poorer, middle, richer, richest), distance to health facility (no problem, not a big problem, big problem), media exposer (yes, no). While for complete immunization one more variable delivery assisted by skilled birth attendant (SBA) (yes, no) was added.[9]

Statistical analysis:

The analysis was carried by using the multi-level mixed effects logistic regression model for rural and urban populations separately. For interpretation, odds ratios (ORs) and 95% confidence intervals (CIs) were reported.

Software used:

Data analysis was carried by using STATA 13.0[16]

Variance Partition Coefficient (VPC):[17]

It explains what proportion of total variance is attributable to variation within-groups and between groups and by definition, it is the ratio of variance for a level to the total variance. The VPC at state and district levels were obtained by using the following expressions as:

$$VPC\ at\ state\ level = \frac{\sigma_{s0}^2}{\sigma_{s0}^2 + \sigma_{d0}^2 + (\pi^2/3)}$$

$$VPC\ at\ district\ level = \frac{\sigma_{d0}^2}{\sigma_{s0}^2 + \sigma_{d0}^2 + (\pi^2/3)}$$

Where,σ_{s0}^2= Var (s_{0k}); i.e., variance between states, σ_{d0}^2=Var (d_{0jk}); i.e., variance between district within state and ($\pi^2/3$) ≈ 3.29 refers to the standard logistic distribution, i.e., the assumed level-1 variance component.

Multilevel logistic model:[18]

Let $\pi_{ijk}$and (1-π_{ijk}) denote the probability of incidence and no incidence of the binary outcome to the i^{th} individual $(i = 1, 2, \dots\dots, n)$ of the j^{th} district $(j = 1, 2, \dots\dots, p)$ in k^{th} state/union territory $(k = 1, 2, \dots\dots, q)$. For the outcome with vector of predictors X:$[X_1 X_2 \dots . X_p]$, the logit function of the multilevel mixed effect logistic model is expressed as:

$$Logit\left(\pi_{ijk}\right) = \beta_0 + \beta' X + (d_{0jk} + s_{0k})$$

Where, $\beta_0$represents the log odds of random effects associated with the individuals, s_{0k}log odds of random effects associated with state and d_{0jk}log odds of random effects associated with the district conditional on state when each predictor equals to zero.

Results:

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Among the rural, mothers in the age group 20-30 years were 85.6%; while urban mothers in this age group were 88.7%. Nearly one third mother and equal in rural and urban were illiterate. Preponderance was of Hindus women in both rural (76.9%) and urban (76.3%) and nearly two fifth belonged to OBC caste (39.6% in rural and 43.6% in urban); while representation of other caste was similar of 17.0% in both rural and urban. Against 30.6% mothers of 1st para and 19.8% of 4th and higher order of rural, 34.3% of 1st para and 17.5% of 4th and higher order women were in urban. The mothers belonging to different wealth quintile were almost similar in both rural and urban; 48.9% in rural and 49.2% in urban were either poorer or poor wealth quintiles. Exposure of mothers to media was slightly higher in urban compared to (32.9% in urban and 32.0% in rural). Distance to health facility stated as a big problem was also same for both the rural and urban mother; but overall, it was about two fifth.

As indicated in **Table-1**, irrespective of categories of selected predictors, the difference between rural and urban for the utilization of full ANC was wider and always higher in urban than the rural. This difference was of even more than 20% in mothers of age group 35-49 years. And in rest of the predictors categories except wealth quintile, the difference varied between 10% to 20%. Although, the full immunization of children was also higher in urban compared to the rural irrespective of the categories of selected predictors. But the difference between urban and rural was minimal below 5%, except in women of age group 35-49 years (9.5%), ST caste category (7.3%), and of middle wealth quintile groups (5.9%).

Table-2 shows the estimated odds ratios (OR's) for full ANCfor rural and urban separately. Each of the selected predictors showed the effect on utilization of full ANC in both the areas. However, education, child birth order, caste, wealth quintile, media exposure and distance to health facility a problem were major predictors. Compared to women of age 15-19 years, full ANC utilization in women of age 20-34 and 35-49 yearswas 1.12 times (95% CI: 1.04 – 1.21) and 1.21 times (95% CI: 1.11 – 1.32) higher in rural women; while it was statistically similar in urban areas.Better utilisation of full ANC in both rural and urban women were with progression in education and economic status. Compared to women with no education, utilisation in highly educated women was 2.01 times (95% CI: 1.88 – 2.14) higher in rural women and 1.96 times (95% CI: 1.79 – 2.14) higher in urban women. Also, as compared to women of poorest wealth quintile, utilisation in richest wealth quintile was 2.32 times (95% CI: 2.17 – 2.49) and 2.65times (95% CI: 2.31 – 3.05) higher in rural and urban women areas respectively. Utilization was poorer with progression of child birth order in both rural and urban. Compared to women of 1st para, the utilization was 0.40 times (OR = 0.60; 95% CI: 0.57-0.63) and 0.56 times (OR = 0.44; 95% CI: 0.40-0.49) lesser in women of para of 4th or 5thand ≥6of rural; while, these in respective child birth order were 0.43 times (OR = 0.57; 95% CI: 0.53-0.63) and 0.55 times (OR = 0.45; 95% CI: 0.38-0.54) lesser in urban women. In both rural and urban, the utilization of ANC in others caste category women were higher compared to SC women(OR = 1.06; 95% CI: 1.01 – 1.11 for rural and OR = 1.20; 95% CI: 1.12 – 1.28 for urban). Poor utilization was also seen in Muslims compared to Hindus women, and also for those distance to health facilities was the problem irrespective of the place of residence. While, in both rural and urban, media exposure enhanced significantly to full ANC utilization. However, the difference of OR's between rural and urban was seen only for caste ($p = 0.047$ for OBC and $= 0.001$ for others) and wealth quintile ($p = 0.029$ for middle, $p = 0.002$ for richer and $p < 0.001$ for richest).

As indicated in **Table-3**, the trends of complete utilization for each selected predictor in their categories were almost similar to full utilizationin both rural and urban women.In rural, complete immunisation of children in women of age 20-34 years and 35-49 years respectively were higher compared to women of 15-19 years (OR: 1.27; 95% CI: 1.12 – 1.45 and OR: 1.34; 95% CI: 1.14 – 1.58). While in urban women, it was statistically similar in all the age groups. Education of women and wealth quintile of the family showed positive association with full immunization in both rural and urban. In rural and urban, full immunisation were respectively 1.48 times (95% CI: 1.32 – 1.67)and 1.39 times (95% CI: 1.16 – 1.66) higher

in highly educated women against women with no education.Compared to poorest women, the OR's in both rural and urban for complete immunization showed increasing trend. Birth order of the child was inversely associated with complete immunization coverage in both rural and urban; higher the child birth order, lower was the complete immunization. In reference to Hindu women,children of Muslim were 0.31 times (95% CI: 0.63 – 0.75)in rural and 0.28 times (95% CI: 0.64 – 0.80) in urban were less immunized. For the women exposed to media as compared to not exposed, complete immunisation of children in rural was significantly higher by 1.09 times, but it did not show association in urban. Women having distance to health facility as big problem had0.16 times(OR: 0.84; 95% CI: 0.79 – 0.89) and 0.21 times(OR: 0.79; 95% CI: 0.70 – 0.89) had lower complete immunisation in rural and urban respectively as compared to those distance was not problem. The likelihood of complete immunization of children was 1.55 times (95% CI: 1.46-1.65) in rural and 1.51 times (95% CI: 1.31-1.74) higher if delivery was assisted by SBA as against those not assisted. However, the difference of OR's for complete immunization of children between rural and urban was seen only for caste (p = 0.044 for OBC and = 0.048 for others).

Discussion:

This study assessed the predictors of full ANC and complete immunization of children for rural and urban separatelyand further, the predictors that behaved differently between rural and urban. The statistical approach adopted was multilevel logistic regression because of hierarchical structure of data.Urban and rural are two different populations that differ for the composition in education, religious believe, health awareness, access to health facilities and other socio-economic factors. Therefore, studying these two different populations collectively may not present the true scenario of the predictors.Also, when data structure is hierarchical in nature,multilevel modelling is more robust approach that specifythe random effects at each level. Use of ordinary logistic model is inappropriate with clustered data, as it presumes independence of all observations; while the observations from the same cluster are generally more similar than from different cluster indicating dependency of the observations. The data set of NFHS-IV used here showed variations at state and district levels in both rural and urban, which is an indication that the variation in outcome of interest (full ANC and complete immunisation) cannot be explained truly by individuallevel measured characteristics. This happens as women living in the same district or state may share similar characteristics like religious believes, access to health care services and socio-economy conditions. Hence, findings of ordinary logistic regression may be inappropriate.[15]

Singh et al (2012) by using the data of NFHS-III (2005–06) had examined the predictors of full antenatal care, safe delivery, and postnatal care in married adolescent for rural India by using the ordinary logistic regression model; the findings presented may be a compromise raising questions because clustering effect was ignored.[19]Similarly, Wulandari et al (2020) had examined the predictors of full ANC by using the ordinary logistic regression model; which is again with compromised result.[12]In the same way, Akowuah et al (2018) used ordinary logistic regression approach on Demographic and Health Survey data in Ghana and showed much of the area-level influences on maternal health (MCH) services.[20]This may be true only if the intra class variability at different levels are absent.

In this present analysis, utilization of full ANC and complete immunization were found always lesser in rural than urban for each category of the selected predictors**(Table-1)**. Antenatal care and full immunisation in India are only in 37.2% women and 61.1% children, which is the consequence of low education and low socio-economic class group, lack of information and access of MCH services. Ithas been pointed that the mothers who lacks recommended ANC services are more likely to give birth to underweight babies of whom survival is poor.[21,22]Since almost 2/3 population in India live in rural areas who are less likely to avail these services compared to urban; more concentrated effort is need for rural women. Therefore, pin pointing the major pockets that are more prone

to non-utilization of these services is of great help to the policy makers.

A substantial difference in OR's between rural and urban were seen for utilization of full ANC and complete immunization, especially with age, education, caste and wealth quintiles of mothers. Moreover, the insignificant OR for a specified category of the predictor in rural women was found to be significant in urban women and visa-vicewas also true(**Table-2 &3**). Among the selected predictors, though, all found associated with utilization for full ANC and complete immunisation; but education, birth order, wealth quintile, distance to health facility were the important in both rural and urban areas; however,more serious in rural than urban. Significant effect of media exposure on immunization seen in only rural that indicates more it to be strengthened for rural. The southern India studyhad demonstrated that media can be an important source of information regarding the benefits of preventive care for maternal health. [23]Utilization of these two MCH services were increasing with progression in level of education and wealth quintile; while decreases with the increasing birth order in both rural and urban. Religion as well as caste also had role to play for full ANC and full immunisation. Adhikari et al (2016) reported education of women had positive effect on utilisation of healthcare services by arguing that education makes mothers confident, brings a feeling of self-worth and self-confidence, and enhances communication with their husbands and other family members on different issues including her own health.[24]Similar to our findings, developing countries studies have shown an inverse relationship between birth order and maternal healthcare utilization. [25]Ahmed et al (2010) while examining the relationship between women's economic, educational and empowerment status and MCH service utilization in developing nations using Demographic and Health Surveys data had also reported utilisation were lower in the poorest wealth quintile and higher in highly educated women; but the finding was based on ordinary logistic model.[26]The most important finding in this analysis was that the likelihood of utilizing full ANC as well as complete immunization was significantly higherin OBC and other caste class in urban than the rural; while higher only for full ANC with wealth quintiles middle, richer and richest.

Limitations:
This cross sectional nationally representative data on women of Indiaprohibits for making any causal claim. Another restraint relates to the measures being self-reported by mothers with a recall period of up to five years. Prior validation studies submit that the sensitivity and specificity of self-reported coverage of maternal and child health indicators can differ substantially when compared to health care records or direct observations.[27]

Conclusion:
The data was hierarchal in nature, so multilevel model was used for more accurate and valid decisions of the predictors. Urban were better performer for full ANC as well as for complete immunization than rural. Moreover,for full ANC, rural urban difference coming out to be significant for OBC and other caste categories and wealth quintile categories with lower odds in rural areas and for complete immunization the rural urban difference coming out to be significant for OBC and other caste categories.This suggests that caste group and wealth quintile groups should be the focus in rural areas in addition to poor education and mothers progressing to higher order births for upliftment of overall coverage.

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Table-1: Distribution of final analytic sample of selected predictor variables for full ANC and full Immunisation by place of residence (NFHS-IV, 2015~2016).

Variables	Full ANC (%)				Full Immunisation (%)			
	Rural		Urban		Rural		Urban	
	N	%	N	%	N	%	N	%
Current age of women								
15-19	4530	34.6	939	47.8	1234	57.8	273	60.1
20-34	115187	33.8	39276	50.5	29653	61.3	9691	65.3
35-49	14806	24.5	4884	46.9	2540	52.5	726	62.0
Women education								
No education	45153	18.4	6995	27.8	10842	50.6	1660	50.8
Primary	20540	29.1	4698	38.9	5068	58.4	1192	62.1
Secondary	59606	41.8	23536	52.7	15049	66.3	5569	66.7
Higher	9224	53.5	9870	64.8	2468	72.4	2269	72.6
Child birth order								
1^{st}	41139	43.0	16667	58.7	11459	65.8	4326	69.7
2^{nd} or 3^{rd}	66701	32.9	23269	48.7	16134	60.6	5289	63.9
4^{th} or 5^{th}	19525	19.0	4049	30.6	4370	51.4	870	52.9
≥6	7158	11.2	1114	19.2	1464	43.9	205	43.9
Religion								
Hindu	103419	33.4	30685	51.6	25499	62.2	7101	67.7
Muslim	14181	27.3	9020	43.0	3730	51.4	2311	57.4
Others	16923	34.1	5394	52.7	4198	57.9	1278	63.5
Caste								
SC	26996	31.3	7666	45.9	6779	63.5	1803	63.9
ST	31272	31.5	5569	48.0	7774	53.1	1374	60.4
OBC	53241	31.0	19677	47.6	13365	62.2	4699	65.3

Others	23014	40.6	12187	57.5	5509	63.0	2814	67.2
Wealth quintile								
Poorest	42774	18.4	1977	22.5	10826	50.1	505	51.4
Poorer	36429	30.4	4300	33.0	8959	58.3	1041	59.0
Middle	27707	40.5	8153	42.5	6906	60.0	2022	65.9
Richer	17590	47.9	13465	50.5	4249	65.0	3299	69.7
Richest	10023	55.6	17204	60.7	2487	71.3	3823	74.3
Media expose								
No	43091	16.6	3476	23.3	10991	51.1	905	50.4
Yes	91432	40.5	41623	52.3	22436	65.1	9785	66.3
Distance to health facility								
No problem	34709	41.9	22856	55.3	8620	66.3	5441	67.9
Not a big problem	46641	33.7	14543	47.3	11546	61.8	3357	63.9
Big problem	53173	26.1	7700	39.8	13261	55.5	1892	58.3

Table-2: Associations between selected predictors and full ANC for rural and urban separately obtained by three level logistic model (NFHS-IV, 2015~2016).

Variables	**Variable's categories**	**Three-level logistic regression model**		**Three-level logistic regression model**		**P-value for difference of OR between rural & urban**
		Rural		**Urban**		
		OR	**95% CI**	**OR**	**95% CI**	
	Intercept	0.39*	0.28-0.55	0.37*	0.27-0.51	
Current age of women	15-19 (Ref)					
	20-34	1.12*	1.04-1.21	1.06	0.92-1.23	0.473
	35-49	1.21*	1.11-1.32	1.06	0.90-1.25	0.113
Education of women	No (Ref)					
	Primary	1.18*	1.13-1.24	1.17*	1.07-1.27	0.841
	Secondary	1.43*	1.37-1.49	1.41*	1.32-1.52	0.633
	Higher	2.01*	1.88-2.14	1.96*	1.79-2.14	0.374
Child birth order	1st(Ref)					
	2nd or 3rd	0.76*	0.73-0.78	0.77*	0.73-0.80	0.729
	4th or 5th	0.60*	0.57-0.63	0.57*	0.53-0.63	0.556
	≥6	0.44*	0.40-0.49	0.45*	0.38-0.54	0.923
Religion	Hindu (Ref)					
	Muslim	0.87*	0.82-0.92	0.84*	0.79-0.90	0.499
	Others	0.96	0.90-1.03	1.06	0.96-1.17	0.102
Caste	SC(Ref)					
	ST	0.95	0.90-1.01	0.96	0.86-1.06	0.870
	OBC	0.99	0.95-1.03	1.06*	1.01-1.13	0.047*
	Others	1.06*	1.01-1.11	1.20*	1.12-1.28	0.001*
Wealth quintile	Poorest (Ref)					
	Poorer	1.33*	1.27-1.38	1.38*	1.20-1.59	0.504
	Middle	1.61*	1.53-1.69	1.77*	1.55-2.03	0.029*
	Richer	1.88*	1.78-1.99	2.11*	1.85-2.42	0.002*
	Richest	2.32*	2.17-2.49	2.65*	2.31-3.05	0.001*
Media exposer	No (Ref)					
	Yes	1.30*	1.25-1.35	1.36*	1.24-1.50	0.252
Distance from health facility	No problem (Ref)					
	Not a big problem	0.92*	0.89-0.95	0.90*	0.85-0.94	0.513

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	Big problem	0.82*	0.79-0.85	0.77*	0.73-0.82	0.154

***significant at α=5%**

Note: Variance (95% CI) and VPC (%) of random effects:

For Rural: Level 2 (district): 0.34 (0.29-0.38), 7.11% & Level3 (state) :1.15 (0.70-1.89), 24.05%

For Urban: Level 2 (district): 0.33 (0.28-0.39), 7.78% & Level 3 (state):0.62 (0.37-1.05), 14.62%.

Table-3: Associations between selected predictors and complete immunisation for rural and urban separately obtained by three level logistic model (NFHS-IV, 2015~2016).

Variables	Variable's categories	Three-level logistic regression model		Three-level logistic regression model		P-value for difference of OR between rural & urban
		Rural		Urban		
		OR	95% CI	OR	95% CI	
	Intercept	0.81	0.61-1.07	0.70	0.46-1.06	
Current age of women	15-19 (Ref)					
	20-34	1.27*	1.11-1.45	1.29	0.99-1.69	0.896
	35-49	1.33*	1.13-1.57	1.33	0.96-1.84	1.000
Education of women	No (Ref)					
	Primary	1.19*	1.10-1.28	1.35*	1.15-1.60	0.084
	Secondary	1.30*	1.22-1.40	1.32*	1.15-1.52	0.801
	Higher	1.42*	1.25-1.60	1.33*	1.11-1.59	0.418
Child birth order	1st(Ref)					
	2nd or 3rd	0.90*	0.85-0.95	0.83*	0.75-0.91	0.219
	4th or 5th	0.84*	0.77-0.91	0.73*	0.62-0.87	0.254
	≥6	0.77*	0.67-0.88	0.57*	0.41-0.79	0.270
Religion	Hindu (Ref)					
	Muslim	0.70*	0.64-0.77	0.72*	0.64-0.82	0.800
	Others	1.09	0.95-1.26	0.91	0.73-1.13	0.175
Caste	SC Ref)					
	ST	0.82*	0.75-0.90	1.01	0.82-1.25	0.105
	OBC	1.01	0.95-1.09	1.16*	1.02-1.32	0.044*
	Others	0.92	0.84-1.01	1.09	0.95-1.26	0.048*
Wealth quintile	Poorest (Ref)					
	Poorer	1.25*	1.17-1.34	1.30*	1.02-1.65	0.695
	Middle	1.45*	1.33-1.57	1.31*	1.04-1.64	0.258
	Richer	1.57*	1.42-1.74	1.48*	1.18-1.87	0.483
	Richest	1.63*	1.43-1.87	1.71*	1.34-2.18	0.573
Media exposer	No (Ref)					
	Yes	1.09*	1.03-1.17	1.14	0.97-1.35	0.580
Distance from health facility	No problem (Ref)					
	Not a big problem	0.94	0.88-1.01	0.93	0.84-1.03	0.873
	Big problem	0.85*	0.80-0.91	0.79*	0.70-0.90	0.405
Delivery assisted by SBA	No (Ref)					
	Yes	1.55*	1.46-1.65	1.51*	1.31-1.74	0.612

***significant at α=5%**

Note: Variances (95% CI) and VPC (%) of random effects:

For Rural: Level 2 (district): 0.31(0.26-0.37), 7.5% and Level 3 (state): 0.50 (0.28-0.87), 12.19%

For Urban: Level 2 (district): 0.19(0.13-0.27), 4.96% and Level 3 (state):0.35 (0.20-0.61), 9.13%