Research Article

LINKAGES BETWEEN MATERNAL AGE AT FIRST BIRTH, BIRTH ORDER WITH MATERNAL AND CHILD HEALTHCARE IN INDIA

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ARTICLE INFO	ABSTRACT

The regional variation of maternal and child health care in India has been established in the earlier literature. However, the study on linkage between birth order, maternal age at the first birth with maternal and child health care utilization across the various socioeconomic and demographic groups in the country are very limited. This paper tries to understand the impact of the birth order and maternal age at the first birth on maternal and child health care utilization. The present study has used the third round of the National Family Health Survey data. Binary logistic regression model has been applied for this paper. The result shows the women who had four or more birth order among them significantly low utilization of at least four ANC visits, safe delivery and full immunization of children age group (12-23 months). But in the context of infant death, the women who had four or more birth order among them infant death is significantly high {Exp (β) = 0.72, CI = 0.64 -0.81} than women had first birth order. The women's age at first child is also highly significantly associated with the maternal and child health care utilization in India.

INTRODUCTION

A report on adolescent girls from low and middle-income countries has been published by the Center for Global Development, highlights the risks to maternal and child health associated with young motherhood (Finlay, Özaltin, & Canning, 2011). Past studies on child health and birth order show that first born children are disadvantaged at birth due to lower birth weight and poor health (Modin, 2002). In India, (Raj *et al*., 2010) found that children born to mothers who were married below the age of 18 were at a higher risk of stunting and underweight as compared to children of women who had married at age 18 or above. On the other hand, the average maternal age at first birth has been rising steadily in the past few decades. But higher maternal age has been associated with adverse pregnancy and birth outcomes (Kato *et al*., 2017). Mothers have multiple options for improving their health status, as well as wellbeing of their children during pregnancy and after delivery through investments in maternal health care access (Makate M, 2016). For instance, pregnant women are encouraged to seek prenatal care early in the first trimester of their pregnancy. Timely and adequate prenatal care has been seen to reduce the risks of adverse birth outcomes, including infant mortality.

Mother's age is one of the dominant factors influencing maternal health as well that of their children. Young maternal age at childbearing is associated with an increased risk of preterm birth and restriction on intrauterine growth of the foetus, infant mortality, and child undernutrition (Fall *et al*., 2015). Both young and advanced maternal age, as well as the birth order of the children, is associated with adverse maternal and child health outcomes. However, studies on the relationship between women's age at the first birth and birth order with maternal and child healthcare are limited. Therefore, this paper aims at investigating the linkage between women's age at birth of first child and birth order with maternal and child healthcare in India in the period during 2005-06.

MATERIALS AND METHODS

Data source: This study used the third wave of the National Family and Health Survey Data (NFHS, 2005-06). The survey conducted by International Institute for Population Sciences under the guidance of Ministry of Health and Family Welfare (MoHFW), Government of India. It covered 29 states including seven union territories, 109,041 households, 124,385 women and 74,369 men of age group 15-54 years. The survey adopted multistage sampling design for data collection.

Outcome measurement: This paper tries to find out two maternal health indicators (four or more ANC visits and safe delivery) and two child health indicators (full immunization of children age 12-23 months and infant death). Four or more

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antenatal care visits of the women is based on the guidelines developed by the Ministry of Health and Family Welfare (MOHFW), Government of India and World Health Organization (MOHFW, 2012; WHO, 2006). Further, this study considers only the most recent births during last three years preceding the survey. Safe delivery indicates that the woman delivered her child in a medical institution, or at home with assistance by a doctor/nurse/Lady Health Visitor (LHV)/Auxiliary Nurse Midwife (ANM)/other health professionals (WHO, 2006). The full immunization of child health considers age group (12-23 months) children, who had taken three doses DPT, three doses Polio, and received BCG and Measles. The full vaccination child is one of the most important indicators of maternal and child health care utilization according to the guidelines developed by the MoHFW and WHO (MoHFW, 2010; WHO, 2006). Second outcome indicator is infant death, and it defines the probability of children dying before the first birthday.

Predictor variables: Socio-economic variables selected for this study are such as births order, women's age at the first births, place of the residence, women education, religions, caste, wealth quintiles, mass media exposure, family structure, and regions of the residence. Births order range from 1 to four or above, Women's age at the first is classified by 11-15, 16-20, 21-25 and 26 and above. Social groups are identified based on the women self-reporting their caste as schedule castes (SCs), schedule tribes (STs), other backward class (OBC), and 'others'. The religion of the mother has categorized as Hindu, Muslim, Christians, and 'others'.

Place of residence is grouped into rural and urban. Women education is categorized by illiterate, primary, middle and above. Mass media exposure is computed women had any mass media exposure and no mass media exposure. Family structure grouped into a nuclear and non-nuclear family. Wealth quintiles range from poorest to richest wealth quintiles. For analysis by regions of the residence the country is divided into six regions based on geographical location and cultural settings (NFHS, 2005-06; P. K. Singh, Rai, Alagarajan, & Singh, 2012). These regions are North (Jammu and Kashmir, Himachal Pradesh, Punjab, Haryana, Rajasthan, Delhi and Uttaranchal), Central (Uttar Pradesh, Madhya Pradesh and Chhattisgarh), East (Bihar, Jharkhand, West Bengal and Orissa), North-East (Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura), West (Gujarat, Maharashtra and Goa), and South (Andhra Pradesh, Karnataka, Kerala and Tamil Nadu).

Analytical approach

Logistic regression analysis has been used to examine the impact of selected socioeconomic and demographic factors on maternal and child health care indicators namely four or more ANC visits, safe delivery, full immunization and infant death. The binary response variables (y, four or more ANC visits or not; safe delivery or not; full child vaccination or not; infant death or not) for each, the individual was related to a set of categorical predictors, X, and a fixed effect by a logit link function which is the following formula.

Logit $(\pi i)= \log [\pi i/1-\pi i]= \beta 0+\beta(X)+\epsilon$

Where, the probability of an individual who received each indicator of maternal and child health is denoted by πi. The parameter $\beta 0$ estimates the log odds of each child health indicators for the reference group, and β estimates maximum

likelihood. The differentials log odds of each maternal and child health care indicators are associated with the predictors X, as compared to reference groups, and ϵ represents the error term in the model. The results of logistic regression are presented by estimated odd-ratio with 95% Confidence Interval (CI). The whole analysis was performed using STATA version 12.0.

RESULTS

Percentages distribution of the birth order by selected background characteristics of women (2005-06)

Table 1 shows the percentage distribution of birth order by selected background characteristics of the women in 2005-06. Overall, the percentages of first, second, third and fourth and above birth order were respectively about 32, 28, 15 and 26 in the last three years preceding the survey. Percentage of first birth order among women who lived in urban areas was about 38 percent, while it was 30 percent among rural women. Fourth (or more) birth order was 16 percent in urban women and 27 percent among women from rural areas. It is seen that uneducated women had a lower percentage of first birth order (20 percent) as compared to women from middle- and higher educated (44 percent). However, the percentage of four (or more) birth order was very low (8 percent) among middle- and higher educated women, while it was considerably high among uneducated women (40 percent).

A smaller proportion of Muslim women had first birth order as compared to women from other religious groups; however, there was higher percentage of four (or more) birth order among Muslim women and women from the Scheduled Tribes (STs) than those from other religious groups. The percentage of the first birth order among women in the the poorest wealth quintile was around 21 as compared to 46 among women from the richest wealth quintile. On the other hand, women from the richest wealth quintile had a low proportion (7 percent) of four (or above) birth order than those in the poorest (41 percent).

Women with any exposure to the mass media had a higher percentage (37 percent) of first birth order, while it was significantly lower (21 percent) among women without any exposure. Women who had any exposure to mass media also had a lower percentage of four birth orders (17 percent) than those who had no mass media exposures (40 percent). The percentage of first birth order among women from nuclear families was seen to be half of that among women from non-nuclear families (20 and 40 percent respectively). However, there was a higher proportion of four (or more) birth order among women from nuclear families than non-nuclear ones (15 and 36 percent respectively). It is also seen that women from the central region of India had a higher percentage (33 percent) of four (or above) birth order than the women from the south (9 percent).

Table 1 Percentage distribution of women's birth order by selected background characteristics during last three years of the preceding the survey in India, 2005-06

Background characteristics	2005-06							
	Birth order							
	1		2		3		≥ 4	
	%	N	%	N	%	N	%	N
Place of residence								
Urban	37.8	4331	31.9	3661	14.5	1660	15.9	1818
Rural	30.0	5677	26.4	4998	16.7	3170	26.9	5087
Women education								

	%	N	%	N	%	N	%	N
Illiterate	20.1	2402	21.3	2540	18.3	2188	40.3	4807
Primary	30.6	1318	28.7	1236	19.5	839	21.1	908
Middle and above	44.4	6288	34.4	4883	12.7	1803	8.4	1190
Religion								
Hindu	34.9	7291	29.9	6234	15.7	3268	19.5	4074
Muslim	26.3	1337	24.7	1255	16.8	853	32.2	1634
Christians	28.6	872	24.9	760	16.3	498	30.1	918
Others	36.1	508	29.1	410	15.0	211	19.8	279
Caste								
Schedule caste	30.4	1628	28.2	1511	17.4	930	24.1	1291
Schedule tribe	27.0	1337	22.9	1135	16.7	828	33.3	1648
Other backward class	32.7	3219	28.2	2771	16.2	1589	23.0	2260
Other	37.8	3385	32.1	2877	14.2	1270	16.0	1434
Wealth index								
Poorest	20.6	1098	20.7	1101	17.3	920	41.4	2205
Poorer	26.8	1509	24.0	1354	17.5	984	31.8	1791
Middle	31.4	1961	27.9	1744	17.3	1082	23.3	1454
Richer	36.3	2452	32.3	2178	16.1	1086	15.3	1031
Richest	46.3	2988	35.4	2282	11.7	758	6.6	424
Mass media exposure								
No exposure	21.2	1554	21.5	1579	17.7	1295	39.6	2902
Any exposure	36.6	8454	30.7	7080	15.3	3535	17.4	4003
Family structure								
Nuclear	20.0	2247	25.8	2893	18.3	2056	35.9	4029
Non-nuclear	40.5	7761	30.1	5766	14.5	2774	15.0	2876
Regions of residence								
North	33.3	1822	29.7	1626	16.7	915	20.2	1105
Central	26.6	1814	24.0	1636	16.8	1143	32.6	2217
East	31.6	1492	27.2	1287	15.7	741	25.5	1203
North-east	31.4	1816	25.4	1472	16.0	926	27.2	1576
West	40.0	1342	32.8	1098	14.9	499	12.3	413
South	40.4	1722	36.2	1540	14.2	606	9.2	391
Total	**31.9**	**10008**	**27.5**	**8659**	**14.9**	**4830**	**25.7**	**6905**

Percentage distribution of maternal age at first birth by select background characteristics of the women (2005-06)

Table 2 shows the percentage distribution of women's age at the first birth during 2005-06. Overall, it was 8, 53, 30 and 9 percent respectively for women aged 11-15, 16-20, 21-25, and 26 years and more. In urban areas it was about 5 percent for women aged 11-15 years as compared to 10 percent for women of the same age group in the rural areas. Among women aged 26 years and more, 14 percent from the urban areas had their first birth at this age, while it was considerably less at 7 percent in the rural areas.

The proportion of uneducated women when they had their first birth at age 11–15 years was higher (14 percent) than that of women in the same age group who had a middle- or higher-level of education (3 percent). Further, among uneducated women who had their first childbirth at 26 and above was significantly lower (4 percent) as compared to about 15 percent of the women in the same age group who had a middle- or higher level of education. Ten percent of Muslim women had their first birth at age 11–15 years, while it was about four percent for women of other religious groups. Further, at age 26 or above, there were fewer Muslim women than those belonging to other religious groups. A similar observation was made with respect to women from the Scheduled Caste groups.

There was also a very low proportion from the richest quintiles who had their first birth at age 11–15 years (0.9 percent) as compared to 16 percent in the poorest quintile. On the other hand, a higher percentage of women in the richest wealth quintile had their first birth at age 26 or above (22 percent) than those in the poorest (3 percent). The influence of mass media was evident. A greater proportion of women (11 percent) who had their first childbirth at age 26 years and above had any exposure to mass media than those who did not

(4 percent). Ten percent of women who had their first birth at 11-15 years were from nuclear families, while the corresponding percentage of women from non-nuclear families was seven. The corresponding percentages for women aged 26 or more was 8 and 10 percent from nuclear and non-nuclear families respectively. Region-wise, the percentage of first births at age 11-15 years for western, northern, and southern regions of the country was 4, 5 and 6 percent respectively. It is also seen that the percentage of women from eastern and central area who had their first birth at age 11-15 years was higher than that for women from the other regions.

Table 2 Percentage distribution of women's age at the first birth by selected background characteristics during last three years of the preceding the survey in India, 2005-06.

Background characteristics	2005-06							
	Women's age at first birth							
	11-15		16-20		21-25		≥ 26	
	%	N	%	N	%	N	%	N
Place of residence								
Urban	4.9	557	45.5	5224	36.1	4146	13.5	1543
Rural	9.5	1795	57.5	10886	26.4	4993	6.6	1258
Women education								
Illiterate	13.5	1608	62.7	7490	19.8	2367	4.0	472
Primary	9.1	390	62.0	2667	25.1	1079	3.8	165
Middle and above	2.5	354	42.0	5953	40.2	5693	15.3	2164
Religion								
Hindu	7.6	1590	53.5	11170	30.1	6279	8.8	1828
Muslim	10.2	519	59.2	3005	25.3	1283	5.4	272
Christians	6.0	184	42.3	1289	34.6	1055	17.1	520
Others	4.2	59	45.9	646	37.1	522	12.9	181
Caste								
Schedule caste	10.0	538	58.6	3143	26.0	1394	5.3	285
Schedule tribe	9.3	460	53.9	2666	27.1	1340	9.7	482
Other backward class	8.0	792	57.8	5683	27.5	2710	6.6	654
Other	4.8	431	45.2	4051	37.3	3344	12.7	1140
Wealth index								
Poorest	15.9	849	63.4	3374	17.7	942	3.0	159
Poorer	11.6	653	63.5	3578	20.7	1166	4.3	241
Middle	8.1	503	59.1	3690	27.2	1700	5.6	348
Richer	4.2	286	50.8	3428	35.5	2392	9.5	641
Richest	.9	61	31.6	2040	45.6	2939	21.9	1412
Mass media exposure								
No exposure	13.8	1009	62.0	4546	20.6	1510	3.6	265
Any exposure	5.8	1343	50.1	11564	33.1	7629	11.0	2536
Family structure								
Nuclear	9.7	1084	55.4	6215	27.0	3026	8.0	900
Non-nuclear	6.6	1268	51.6	9895	31.9	6113	9.9	1901
Regions of residence								
North	5.0	274	48.8	2671	37.6	2056	8.5	467
Central	9.0	612	62.0	4219	24.8	1686	4.3	293
East	12.4	587	60.9	2878	21.8	1028	4.9	230
North-east	8.1	468	46.1	2672	30.9	1791	14.8	859
West	4.0	133	48.3	1618	33.4	1118	14.4	483
South	6.5	278	48.2	2052	34.3	1460	11.0	469
Total	**7.7**	**2352**	**53.0**	**16110**	**30.1**	**9139**	**9.2**	**2801**

Determinants of maternal health care utilization, 2005-06

Table 3 shows the results of multivariate analysis of women who had four or more ANC visits. Two models were used. Model I considered women's birth order and women's age at first birth, predictors have used for analysis of at least four ANC visits and safe delivery.

Analysis of 2005-06 data using Model II shows the likelihood of at least four ANC visits after adjusting for birth order, woman's age at first birth, place of the residence, education level, religion, caste, wealth quintiles, exposure to mass media, family structure and regions of the residence. All the selected

predictors are highly significant determinants of the likelihood of women making at least four ANC visits. Higher birth order women were significantly less likely to make at least four ANC visits. A positive and significant association is found between age at the first birth and making at least four ANC visits. Women from rural areas are significantly less likely {Exp (β) = 0.64, CI = 0.60- 0.69} to make at least four ANC visits as compared to women from urban areas. Analysis also shows that Middle- and higher-educated women were about two times more likely {Exp (β) = 2.03, CI = 1.87-2.22} to make at least four ANC visits than uneducated women. Muslin women were significantly less likely {Exp (β) = .51, CI = .44-.59} to make at least four ANC visits as compared to Hindu women. Other caste women were more likely {Exp (β) = 1.31, CI = 1.19-1.45} to make at least four ANC visits as compared to women from the Scheduled castes. Women from the richest wealth quintiles were about six times more likely {Exp (β) = 6.17, CI = 5.31-7.17} to make at least four ANC visits as compared to women from the poorest

wealth quintiles. Women who had any exposure to mass media were more likely {Exp (β) = 1.56, CI = 1.42-1.71} to make the minimum recommended ANC visits than those who had none. It is also seen that non-nuclear families were less likely {Exp (β) = 0.92, CI = 0.86-0.99} to make at least four ANC visits than women from nuclear families. Women from the southern region of India were about seven times {Exp (β) = 7.6, CI = 6.72-8.59} more likely to make at least four ANC visits than women from the north.

Using Model, I on 2005-06 data, it is seen that women's birth order and age at first birth were highly significant determinants of utilization of safe delivery services. A similar result was obtained with Model II for the predictor of birth order and women's age the first birth. Women from rural areas were seen to be less likely {Exp (β) = 0.52, CI = 0.48-0.55} to access safe delivery services as compared to urban women.

Table 3 Binary logistic model showing Exp (β) and 95% Confidence Interval (CI) for women who had most recent birth as well as four or more ANC visits and safe delivery by selected background characteristics during last three years preceding the survey in India, 2005-06

Background Characteristics	Four or more antenatal care (ANC) visits				Safe delivery			
	2005-06				2005-06			
	Model I		Model II		Model I		Model II	
	Exp(β)	95% CI	Exp(β)	95% CI	Exp(β)	95% CI	Exp(β)	95% CI
Birth Order								
1®	1		1		1		1	
2	0.83***	.78 - .89	.75***	.69 - .81	.66***	.63 - .71	.56***	.52 - .60
3	0.51***	.47 - .55	.63***	.57 - .69	.39***	.36 - .42	.44***	.41 - .49
≥ 4	0.23***	.21 - .25	.49***	.44 - .54	.19***	.18 - .21	.41***	.38 - .45
Women age at first birth								
11-15®	1		1		1		1,	
16-20	1.62***	1.44 - 1.82	1.28***	1.12 - 1.47	1.7***	1.53 - 1.9	1.29***	1.13 - 1.46
21-25	3.2***	2.83 - 3.61	1.65***	1.43 - 1.91	3.52***	3.15 - 3.95	1.79***	1.56 - 2.05
≥ 26	6.11***	5.29 - 7.07	2.38***	2.0 - 2.85	7.34***	6.39 - 8.44	3.03***	2.55 - 3.6
Place of Residence								
Urban®			1				1	
Rural			.64***	.60 - 69			.52***	.48 - .55
Women Education								
Illiterate®			1				1	
Primary			1.47***	1.33 - 1.62			1.58***	1.44 - 1.73
Middle and above			2.03***	1.87 - 2.22			2.13***	1.96 - 2.30
Religion								
Hindu®			1				1	
Muslim			.86***	.78 - .94			.76***	.69 - .83
Christians			.51***	.44 - .59			.65***	.56 - .75
Other			1.17***	1.0 - 1.36			1.21**	1.04 - 1.41
Caste								
Schedule Caste (SC)®			1				1	
Schedule Tribe (ST)			1.01***	.89 - 1.14			.71***	.63 - .81
Other Backward Class (OBC)			.96***	.87 - 1.05			.96ns	.87 - 1.04
Other			1.31	1.19 - 1.45			1.24***	1.13 - 1.36
Wealth quintiles								
Poorest®			1				1	
Poorer			1.25***	1.11 - 1.42			1.42***	1.27 - 1.59
Middle			1.9***	1.68 - 2.15			2.23***	1.98 - 2.49
Richer			2.7***	2.37 - 3.08			3.52***	3.12 - 3.97
Richest			6.17***	5.31 - 7.17			8.83***	7.65 - 10.21
Mass Media Exposure								
No Exposure®			1				1	
Any Exposure			1.56***	1.42 - 1.71			1.32***	1.21 - 1.44
Family Structure								
Nuclear®			1				1	
Non-nuclear			.92***	.86 - .99			.97ns	.91 - 1.04
Regions of residence								
North®			1				1	
Central			.62***	.56 - .69			1.0ns	.91 - 1.11
East			1.09ns	.98 - 1.22			1.98***	1.78 - 2.21
North-East			1.34***	1.19 - 1.51			1.46***	1.3 - 1.63
West			2.12***	1.86 - 2.38			3.42***	3.05 - 3.85
South			7.6***	6.72 - 8.59			8.9***	7.88 - 10.0

Note: ®: Reference Category. Level of Significance: * p<0.10; **p<0.05; ***P<0.01; ns: not significant

Women with middle- and higher-levels of education were about three times more likely {Exp (β) = 2.13, CI = 1.96-2.30} to utilize safe delivery services than women without an education.

Women from other religious groups and those from other castes were significantly more likely to utilize safe delivery services as compared to Hindu and Scheduled Caste women respectively. Women from the richest wealth quintile were nine times more likely {Exp (β) = 8.83, CI = 7.65-10.21} to utilize safe delivery services than women in the poorest wealth quintile. Women with any mass media exposure were also more likely {Exp (β) = 1.32, CI = 1.21-1.44} to utilize safe delivery services as compared to women who had no mass media exposure. Analysis also showed variations across regions. Women from the Eastern, North-east, West and Southern regions showed significantly greater likelihood of

utilization of safe delivery services than women belonging to the Northern region in India.

Determinants of child health care utilization, 2005-06

Table 4 shows the result of multivariate analysis of data on full immunization of children aged 12−23 months for the period 2005-06 using Models I and II.

In 2005-06, women's birth order, age at the first birth, place of residence, women's education, religion, caste, wealth quintiles, mass media exposure, family structure and regions of the residence were the significant determinants of full immunization of children aged 12-23 months. Birth order and women's age at first birth are seen to be significant determinants of full vaccination of children aged 12−23 months during the period 2005-06 also.

Table 4 Binary logistic model showing Exp (β) and 95% Confidence Interval (CI) for full immunization of the children age group (12-23 months) and infant death by women's selected background characteristics during last three years preceding the survey in India, 2005-06

Background Characteristics	Children's age (12-23 months) full Immunization				Infant death			
	2005-06				2005-06			
	Model I		Model II		Model I		Model II	
	Exp(β)	95% CI	Exp(β)	95% CI	Exp(β)	95% CI	Exp(β)	95% CI
Birth Order								
1®	1		1		1		1	
2	.93ns	.84 - 1.03	.95ns	.84 - 1.06	.66***	.59 - .73	.63***	.56 - .70
3	.64***	.57 - .72	.85**	.74 - .97	.67***	.58 - .76	.56***	.49 - .64
≥ 4	.36***	.32 - .40	.71***	.61 - .81	.93ns	.84 - 1.03	.72***	.64 - .81
Women age at first birth								
11-15®	1		1		1		1	
16-20	1.46***	1.23 - 1.74	1.16ns	.96 - 1.4	.80***	.71 - .89	.84***	.75 - .95
21-25	2.46***	2.05 - 2.95	1.53***	1.25 - 1.88	.61***	.53 - .70	.74***	.64 - .86
≥ 26	3.76***	3.02 - 4.68	1.96***	1.53 - 2.51	.56***	.44 - .70	.79*	.61 - 1.01
Place of Residence								
Urban®			1				1	
Rural			1.14**	1.01 - 1.27			1.04ns	.92 - 1.17
Women Education								
Illiterate®			1				1	
Primary			1.51***	1.31 - 1.74			.95ns	.84 - 1.07
Middle and above			2.23***	1.97 - 2.53			.62***	.54 - .70
Religion								
Hindu®			1				1	
Muslim			.58***	.50 - .66			.83***	.74 - .95
Christians			.57 ***	.46 - .70			1.16ns	.82 - 1.64
Other			1.18ns	.94 - 1.49			1.03ns	.78 - 1.35
Caste								
Schedule Caste (SC)®			1				1	
Schedule Tribe (ST)			.91ns	.76 - 1.09			.89ns	.77 - 1.05
Other Backward Class (OBC)			.95ns	.83 - 1.09			.92ns	.83 - 1.03
Other			1.14*	.99 - 1.31			1.7ns	.94 - 1.22
Wealth quintiles								
Poorest®			1				1	
Poorer			1.23**	1.04 - 1.45			1.02ns	.92 - 1.14
Middle			1.85***	1.57 - 2.19			.94ns	.83 - 1.07
Richer			2.15***	1.79 - 2.59			.78***	.65 - .92
Richest			3.44***	2.78 - 4.25			.58***	.46 - .72
Mass Media Exposure								
No Exposure®			1				1	
Any Exposure			1.37***	1.2 - 1.55			1.05ns	.95 - 1.15
Family Structure								
Nuclear®			1				1	
Non-nuclear			.89**	.80 - .98			1.01ns	.93 - 1.11
Regions of residence								
North®			1				1	
Central			.67***	.58 - .78			1.21***	1.05 - 1.4
East			1.24**	1.05 - 1.46			.99ns	.85 - 1.14
North-East			.63***	.53 - .76			.99ns	.75 - 1.30
West			.96ns	.81 - 1.14			.81**	.67 - .97
South			1.27***	1.07 - 1.5			.77***	.65 - .92

Note: ®: Reference Category. Level of Significance: * p<0.10; **p<0.05; ***P<0.01; ns: not significant

Women from rural areas were significantly more likely {Exp (β) = 1.14, CI = 1.01-1.27} to have their children fully immunized than urban women. Women with a middle- or higher-level of education were two and half times more likely {Exp (β) = 2.23, CI = 1.97-2.53} to have their children vaccinated than women who were uneducated.

The children of Christians women were less likely {Exp (β) = 0.57, CI = 0.46-0.70} to be fully immunized than Hindu women. Other caste women significantly more likely {Exp (β) = 1.14, CI = 0.99-1.33} to have their children fully vaccinated than women from the scheduled castes. Women from the richest wealth quintiles were thrice as likely {Exp (β) = 3.44, CI = 2.78-4.25} to fully immunize their children than women from the poorest wealth quintile. Women with any exposure to mass media were more likely {Exp (β) = 1.37, CI = 1.20-1.55} to get their children immunized than women who had no exposure. Women from non-nuclear families were less likely {Exp (β) = 0.89, CI = 0.80-0.98} to avail of full vaccination services than women from nuclear families. Those from the southern region were seen to be significantly more likely {Exp (β) = 1.27, CI = 1.07-1.50} than those from the north to have their children fully immunized.

In 2005-06, birth order, women's age at the first birth, women's education, religion, wealth quintiles and regions of the residence are the significant determinants of the infant mortality in India. Birth order and the mother's age at first birth are significant determinants of infant mortality in both Models I and II. Women with second birth order were about half times less likely {Exp (β) = 0.66, CI = 0.59 - 0.73} to lose their children than women with first birth order. Similarly, results were observed among women whose age at first birth was 26 and above years.

In Model II, birth order and women's age at first birth is nearly similar (to Model I) in their significance as determinants of Infant deaths in 2005-06. Women with middle and higher levels of education were significantly less likely {Exp (β) = 0.62, CI = 0.54 - 0.70} lose their children as compared to women without an education. Children of Muslim women {Exp (β) = 0.83, CI = 0.74 - 0.95} were less likely to die than those born to Hindu women. Women from the richest wealth quintiles were significantly less likely {Exp (β) = 0.58, CI = 0.46 - 0.72} to lose their children than women from the poorest wealth quintile. A lower likelihood of infant mortality is seen in the southern region {Exp (β) = 0.77, CI = 0.65 - 0.92} in comparison to the north.

DISCUSSION

Notwithstanding the considerable progress has achieved in reducing maternal mortality, India's commitment to the attainment of low maternal mortality rate and improve maternal and child health's goal is unlikely to be achieved. The Government of India's guidelines state that every pregnant woman must avail of four or more antenatal visits. Besides these, there are major concerns over the persistent regional socio-economic inequalities in India. The nation also performs poorly on maternal health as is evident from high maternal mortality rate, low utilization of MCH and high fertility rates, especially in the northern states of the country (International Institute for Population Sciences, 2007–2008). Against this background, this study is an attempt to identify the association of women's birth order and their age at the first birth with the

utilization of the MCH care services after adjusting for the women's background characteristics in the period 2005-06.

Results presented in this paper suggest that factors, such as the birth order of women and their age at first birth, have highly significant association with the utilization of at least four ANC visits. These findings are consistent with other contemporary studies which have identified socio-economic and regional factors related to maternal and child health (Hajizadeh, Alam, & Nandi, 2014). Several studies show that women with a fewer number of children prefer to use more ANC services (Pell et al., 2013; P. K. Singh, Kumar, Rai, & Singh, 2014), whereas high parity mothers receive experience from their past births and show lower concern for utilizing ANC services (Arthur, 2012).

The findings of this study also show that woman's age at first delivery is highly associated with MCH care. A similar result was obtained, especially for birth weight, gestational period, child nutritional status, and schooling, which is consistent with other studies (Fall et al., 2015) which found that children of older mothers are at increased risk of preterm birth, and might have increased plasma glucose concentrations in adult life. However, at a given socioeconomic level and parity, children of older mothers have certain advantages in terms of childhood nutrition and educational attainment. The present study finds that women who were of a higher age at first birth (26 and above year) performed better in terms of MCH indicators. But this finding contradicts other studies (Heffner, 2004; Hsieh et al., 2010) which suggested that, from an obstetric perspective, older maternal age is associated with increased risks of adverse pregnancy and birth outcomes.

The findings of the present study also show that women's birth order and age at first birth are significantly associated with utilization of safe delivery services. This is consistent with the results of other studies which show that in rural India, safe delivery is more common for the first childbirth than higher birth orders (Kesterton, Cleland, Sloggett, & Ronsmans, 2010). Women of first birth order have greater probability of using maternal health care services for their first child (Celik & Hotchkiss, 2000). The findings also highlighted limited utilization of safe delivery services for the second and the higher order births as compared to the first birth in the period of study 2005-06. There are three plausible reasons for this (L. Singh, Rai, & Singh, 2012). First, women in their first pregnancy pose greater health risks and are probably more cautious about their pregnancy (Raj, Saggurti, Balaiah, & Silverman, 2009). Second, as the number birth increases, women may tend to believe that modern maternal and safe delivery services are not necessary and tend to rely more on experience (Mekonnen, 2002). Third, higher birth order suggests a greater family size and hence, less resources (time and money) are available for seeking healthcare (C. Bhatia & Cleland, 1995; Wong, Popkin, Guilkey, & Akin, 1987).

The results suggest a lower probability of safe delivery among women who had their first birth while still in their teens. Similar findings by El Shiekh & van der Kwaak (2015) indicate that adolescent pregnancy affects utilization of safe delivery. Further, L. Singh et al., (2012) found that women who are less than 18 years tend to make less use of safe delivery services than older women (18-19 years). Results also confirmed that women with higher birth order and their children are less likely to utilize full immunization services.

However, a positive relationship is observed between woman's age at first birth and full vaccination of children aged 12−23 months. But few studies have found a positive relationship between mother's age and utilization of maternal and child healthcare services (Celik & Hotchkiss, 2000; Pebley, Goldman, & Rodriguez, 1996). A longitudinal study in Japan, conducted by Kato *et al*. (2017) suggested that older maternal age may be beneficial for early maternal and child health. Older mothers may be more aware and concerned over their children's exposure to nutritional risks and injury. They may also have higher health literacy (depending on the socioeconomic status of the women) while managing their children's illness, thereby avoiding hospitalization, as compared to younger mothers. The risk of children having unintended injuries requiring medical attention declined with increasing maternal age (Sutcliffe, Barnes, Belsky, Gardiner, & Melhuish, 2012).

Mother's parity and her age have shown to increase the risk of adverse neonatal outcomes, such as intrauterine growth restriction (IUGR), prematurity, and mortality (Kozuki *et al*., 2013). High parity has been linked to increased risk of hypertension, and uterine rupture (Shah, 2010). Several studies have reported increased rates of neonatal mortality among young mothers (Cassandra M. Gibbs, Amanda Wendt, Stacey Peters, & Carol J. Hogue, 2012; Scholl *et al*., 1992). A possible biological explanation may be incomplete maternal physical growth and relative malnutrition, which are related to the mother's gynecological age (C. M. Gibbs, A. Wendt, S. Peters, & C. J. Hogue, 2012). This study also found that women from higher socio-economic backgrounds performed better in the use of the MCH care services. Evidence from similar studies suggest that higher socioeconomic status women and their children (e.g., higher economic status and educational attainment) are beneficial for maternal and child health (Pillas *et al*., 2014; Power, Kuh, & Morton, 2013).

CONCLUSION

Results of the present study lead to the conclusion that there is significant association found between women's age at first birth and birth order with maternal and child health care in India according to the background characteristics of the women in the period 2005-06. Women with four or higher birth orders were less likely to utilize all four ANC visits or more. It was also found that women who had their first childbirth at 26 years or more were more likely to use ANC services. Increased likelihood of utilizing ANC services was also observed in women who had middle or higher educational attainments.

Economic wellbeing increases utilization of maternal and child healthcare services. Results show that women from the richest wealth quintiles, as well as those from the southern region, tend to more utilize four or above ANC visits as compared to women from the poorest quintile, and other parts of India. Findings of the study revealed that utilization of safe delivery and full vaccination of children aged 12−23 months are more in better-educated and wealthy households. Women from Urban areas and nuclear families are more likely to make at least four ANC visits and use safe delivery services utilization than women from rural areas and non-nuclear families.It is also seen that Schedule Caste (SCs) women and those from the poorest wealth quintile are less likely to make at least four ANC visits and use safe delivery services during the reference period (2005-06). Women with low exposure to mass media are also less likely to make ANC visits and utilizing safe delivery services.

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