Trends and correlates of low birth weights in selected states of India: An analysis of NFHS data

Introduction and review of literature

Despite significant efforts to reduce the infant mortality rate in India, the issue remains an on going policy concern. Some states have reached the targeted value of IMR where as some are far behind the targeted value .There are multiple factors required for increasing the value of IMR. Although it remained the primary health indicator, low birth weights (LBW) is also an indicator of considerable interest (Lewis *et al*, 1985). Babies having a birth weight of 2500 grams or less are recorded as LBW by WHO and known to have poor health and therefore poor chance of survival, high mortality in childhood is associated with LBW. Poor health of mothers which is directly related to higher incidence of LBW babies is also responsible for maternal mortality, and is a indicator of poor health status of mother in the society (WHO,1990). In India 30 percent babies are known to have LBW. Poor health of mothers which is directly related to higher incidence of LBW babies is also responsible for higher maternal mortality. And it is indicative of the poor health of woman in the population. Birth weight is an indicator for pregnancy out come also.

Clinical experts, epidemiologists, and Demographers have found consistently that the risk of death during infancy increases among the premature births and LBW infants (Cramer, 1987). Social demographers have had a long-standing interest in analyzing the determinants of adverse birth outcomes, including LBW and prematurity (Frisbie *et.al., 1996*).

From the study in Boston (Wise *et. al.,*1988) suggested that in early 1980's increase in the rates of LBW and IMR were associated with decrease in economic conditions of disadvantageous group. Singh in 1996 found that, actual increase in the rates of IMR and LBW have accused among children from economically and socially backward groups as well as among children in the lowest socio economic category. (Cooley *et. al.,* 2000) suggested that mothers giving birth to LBW female babies were themselves likely to have been LBW infants when they become mothers.

As early as 1930, Yllpo suggested the use of 2500 grams as a standard of infant's weight during birth. The risk of neonatal deaths was higher for the infants with birth weight less 2500 grams. LBW infants were almost 40 times more likely to die during the neonatal period than the infants with normal birth weight and the chance of deaths for infants weighing 1500 grams or less at births were almost 200 times higher.

In this paper we have made an attempt to study the birth weight of infants especially low birth weight (LBW) which is internationally used as an indicator of child mortality & morbidity and also it is an important subject of national concern and health policy. LBW has

been shown to be associated with higher risk of mortality and childhood morbidity (McCormick, 1985). In the light of above facts, it was decided to undertake a study of the bio-demographic and socio-economic correlates of Birth weight of infants among newly born(s) in some selected Indian State. The states has been selected in accordance with the TFR (greater than3.00 and less 2.1) as per NFHS -3(National Family and Household Survey). This classification has been made in order to have more detailed statistical analysis and been examine the impact on different characteristic.

Need for the study

We are interested in studying the incidence of LBW which is the hidden cause for higher IMR particularly higher neonatal mortality rates (NNMR) (Deaths within 4 weeks after live birth). Birth weights have strong associations with the infant mortality thus it can serve as a proxy for infant mortality itself (Eberstein and Parker, 1984). Infants' death due to LBW is more concentrated during neonatal period than post neonatal period. A study conducted by Gortmaker in 1979 found that because of LBW the probability of dying during neonatal periods is 50 percent higher than that of post neonatal period. Socio-economic and bio-demographic characteristic influences the IMR through LBW may have strong effects on neonatal mortality. Most of the time emphasis has been made on studying IMR, and causes and consequences responsible for variation in IMR. Even National Population Policies, (NPP 2000) in their objectives National Social-Demographic Goals for 2010 has emphasized on reducing IMR 30/1000 live births. As low birth weight of babies is one of the factors for infants' deaths, so in this paper an attempt has been made to examine the impact of various socio-economic and bio-demographic characteristic affecting the low birth weight of the babies and also examine the trend of low birth weight babies in the past 15 years.

Objectives

The broad objective of the study is to examine the correlates of LBW in the selected states of India. The specific objectives are:

1. To study the trends and patterns of LBW of the newly born babies in India and some selected Indian states.
2. To assess the covariates of LBW across the selected states of India.

Data source

The data for the present analysis has been extracted from three rounds of National Family Health Survey (NFHS). In order to meet the first objective we made use of NFHS-1, NFHS-2 and NFHS-3. To meet the second objective only NFHS-3 has been used. To maintain the similarity in the three sets of data, the present analysis is based on last three years birth history file for all the three NFHS. The selected states for the current study are Andhra Pradesh, Kerala and Tamil Nadu with Total fertility rate (TFR) less than 2.1. The other states are Bihar, Madhya Pradesh, Rajasthan and Uttar Pradesh with TFR greater than 3.0.

Methodology

Bivariate analysis and binary logistic regression analysis have been carried out to meet the specific objectives of the study. For regression analysis, three models have been used. The objective was to assess the relative importance of each of the variable in different set of variables. In the first model, only socio-economic variables are included. In the second model only bio-demographic variables are taken and in the third model regression is performed taking all the variables.

Dependent variable: The birth weights of the baby are classified into two groups that is low birth weights (weights less than or equal to 2499 grams) and normal birth weight (weight greater than or equal to 2500grams to 4000 grams). The dependent variable is the LBW among infants to women in the age group (15-49).

The set of *independent variables* considered for the study are

Socio-economic variables: *(a) Place of Residence:* A rural women in India gets pregnant about 6-8 times during her reproductive period and spend about 16 years in pregnancies and lactation periods and gives birth to more than 6 children's of about which 4 survive (Mukherji S and Coyaji, 1991). Mortality levels are found to be higher in rural areas than urban areas not only because of their economic conditions but also due to their access to medical and educational facilities (Jain, 1985; Mahy, 2003).This variable is divided into 2 categories i.e. urban and rural, many literatures have reveled that LBW infants are more contributed by rural population than that of the urban areas. *(b) Religion and Caste:* Because of larger proportions of Hindus in India we have stratified religion into Hindus as one group and remaining other religions into another group. The effect of religion and castes arise due to the difference in the life style based on tradition and beliefs (Pandey *et al*., 1999. We have stratified the caste SC/ST as one group and others as another. *(c) Educational status of women*: The results from various health and health care variables suggest that the effects of community education/individuals educations operates throughout the use of maternal services and other preventive health services the child nutrition and the mothers care for the sick child (O. Kravdal, 2004). Literature on fertility says that education is negatively related to fertility. Even individual educations play a significant role in antenatal/pre antenatal care. It is classified as (non-literate, primary, secondary and higher).For the analysis purpose we have categorized the educational status of women in to four categories that is non-literate, primary schooling completed, secondary schooling completed and higher. *(d) Wealth Index:* Mortality is far great in LBW children than in the normal weighted children. We have categorized this variable into three parts that is poor and poorest, middle and rich, richest. *(e) Mass Media exposure:* We have stratified them as non exposed, partial exposed and full exposed. *(f) Occupation of women:* We have categorized this variable into three categories that is Non working, Non agricultural work, Agricultural work it includes (self employment and also working in others field).

Bio-demographic variables: *(a) Age at first birth:* Maternal age is also associated with infants' survivals; babies born to teenage mothers run a high risk of LBW and early deaths (Friede, 1987). Births to very young mothers may experiences difficulty in pregnancies and

deliveries because of their physical immaturity and because they are likely to have limited knowledge and confidence in caring for infants. Similarly women in the higher age group (30 and above) also experiences age related problems during pregnancy and delivery. Thus mortality among LBW children is to some extent influenced by age of mothers at first birth. *(b) Sex of the child*: Many studies have shown that males are at higher risk of dying than females during neonatal and post neonatal age due to biological factors (Pearce, 2003). *(c) BMI:* Nutritional status of women, measured by body mass index (BMI).Birth weight of infant is highly sensitive to nutritional status of women (Prasad *et.al, 1994)*. It is categorized as less than 18.4kg/m^2,18.5-24.9kg/m^2 and greater than or equal to 25 kg/m^2 (NFHS-3). *(d) Birth order and Birth interval*: Higher risk of mortality prevails for children's with short birth intervals, since their mothers are likely to have poor health (Rustin, 2000). The very reason for mortality of infants' death is due to gestation period which in turn results into LBW or pre matured births. Higher birth order also is associated with infant mortality, and for mothers who are younger than 18 years of age or are more than 35 years at time of pregnant have higher chance for LBW infants. As for parity, declining parity and postponement of pregnancy to later ages may aid infant survival (Knodel and Hermalin 1984). We have categorized birth order into three categories viz. first order birth, birth of order 2 or 3; birth of higher order (4 and above). Birth interval is categorized as less than or equals to 2 years and greater than 2 years. *(e) Anemia level:* Following the specified categories in the NFHS report, we have grouped the mothers into three groups on the basis of hemoglobin level. These three groups are severe (Hg level less than 7.0 g/dl) or moderate (7.0-9.9g/dl), mild (10.0-11.9 g/dl) and non-anemic (less than 12.0g/dl). *(f) Antenatal Care and Pregnancy complications:* Studies have revealed that ANC and delivery under safe and hygienic condition are measures for reducing maternal mortality therefore ANC can be used as a preventive approach. We have categorized the variables as no antenatal care (women who have not accessed to any of the antenatal care visits in any of the trimesters during her pregnancy period, no tetanus injection, no syrup) and any antenatal care (it involves taking of syrup, tetanus injection & antenatal care visits at least once during her pregnancy period). Pregnancy complications is categorized as no complications (that is if a women at the time of pregnancy did not suffer from fever, no swelling of hands /legs/face, no excessive fatigue & virginal bleeding and any complications(if she suffered from any of these fever, swelling of hands/legs/ face, excessive fatigue and vaginal bleeding).

Binary Logistic Regression: The required covariates of LBW are extracted from various literatures and have been used according to their availability and the adequate sample sizes. Since the low birth weights has the dichotomous outcome, and all most all the independent variables are categorical in nature, a multiplicative binary logistic regression model has been used to quantify the risk of LBW respective to the categories of various independent variables. The model can be expressed as:

$\Omega^* = \Omega e^b$

or, $e^b = \Omega^*/\Omega$

Where, $\Omega^* = e^{a+bx}e^b$ and $\Omega = e^{a+bx}$

and e^b represent the multiplicative effect of a one-unit change in predictor variable on the odds of response variable (Rutherford and Choe, 1993) which is popularly know as odds ratio.

However, when the independent variable is categorical, the equation takes the form:

$\Omega_2=\Omega_1 e^b$

$\Omega_3=\Omega_1 e^c$, $\Omega_2=\Omega_3 e^{b-c}$ Where 1, 2, 3 are the categories of the independent variable

Results and discussion

Before entering into the results it is worth while to mention that in the low fertility states[1] 84.6 percent of all the births were weighed, 10.5 percent of the births were not weighed and around five percent of the new born mothers told that they don't the weight at birth of their babies. In the high fertility states[2] 21.2 percent of all the births were weighed, around 73.5 percent of the births were not weighed and around five percent of the new born mothers told that they don't the weight at birth of their babies.

Table 1 provides information about the percentage of low birth weight babies by socio-economic and demographic characteristic in the selected low fertility states and high fertility states in 2005-2006. In the *low fertility states* 21 percent of the births of those mothers belonging to SC/ST category are low birth weight, while 15 percent of the births are low birth weight of those mothers from other category. Education plays an important role; as educational level increases the percentage of low birth weight babies decreases. Among women with no education 21 percent of the births are low birth weight; among women with primary level of education 18 percent gave birth to low birth weight babies; among women with secondary level of education 15 percent gave birth to low birth weight babies and among women with higher level of education only 9 percent gave birth to low birth weight babies. Birth weight of babies also depends upon the wealth index. 21 percent of the newborns of those mothers belonging to poor and poorest wealth quintile were low birth weight babies while the percentage is 11 percent among women in the rich and richest wealth quintile. Work status of women also matters; 22 percent of women who were engaged in agricultural work gave birth to low birth weight babies and the corresponding percentages for those women who are not working or working in non agricultural sector is 15 percent. 20 percent of births of those mothers living in rural areas were low birth weight while 13 percent of births of mothers from urban areas had low birth weight. Women who were not exposed to mass media 21 percent of them gave birth to low birth weight babies and the women who were fully exposed to mass media records lesser percentage of low birth babies (14 percent).

In the *high fertility states* 31 percent of the births of those mothers belonging to SC/ST category are low birth weight, while 24 percent of the births are low birth weight of those mothers from other category. Education plays an important role; as educational level increases the percentage of low birth weight babies decreases. Among women with no education 32 percent of the births are low birth weight; among women with primary level of education 29 percent gave birth to low birth weight babies; among women with secondary

[1] Includes Andhra Pradesh, Kerala and Tamil Nadu.

[2] Includes Bihar, Madhya Pradesh, Rajasthan and Uttar Pradesh

level of education 24 percent gave birth to low birth weight babies and among women with higher level of education only 18 percent gave birth to low birth weight babies. Birth weight of babies also depends upon the wealth index. 30 percent of the newborns of those mothers belonging to poor and poorest wealth quintile were low birth weight babies while the percentage is 21 percent among women in the rich and richest wealth quintile. Work status of women also matters; 31 percent of women who were engaged in agricultural work gave birth to low birth weight babies and the corresponding percentages for those women who are not working or working in non agricultural sector is 24 percent. 28 percent of births of those mothers living in rural areas were low birth weight while 24 percent of births of mothers from urban areas had low birth weight. Women who were not exposed to mass media 21 percent of them gave birth to low birth weight babies and the women who were fully exposed to mass media records lesser percentage of low birth babies (22percent).

Table 2 gives the information about the percentage of low birth weight babies by bio-demographic characteristic in the selected low fertility states and high fertility states in 2005-2006. In the *low fertility states,* low birth weight of babies also depends upon the age of the mother at first birth. Women in the age group less than 20 years have higher percent of giving low birth weight babies may be due to physical maturity, lack of knowledge about the maternal care utilization. Than those women in the age group greater than 30 years that is they have only 11.1 percent of low birth weight babies. Anemia level among women with severe and moderate category has 22.1 percent of low birth weight babies than those women in the category with non anemic has 14.9 percent. Birth order higher birth order has 20.4 percent of low birth weight babies than those women with birth order one that is they have 14.8 percent of low birth weight babies. Lesser the BMI higher the chances of low birth weight babies that women in the category less than 18.4kg/m2 has 21.0 percent of low birth weight babies than those women with BMI greater than 25kg/m2 and their percent of low birth weight babies are 11.8 percent.BMI depends upon the nutritional status of women. Women who do not take any antenatal care has 41.6 percent of giving birth to low birth babies, 19.5 percent of low birth weight babies are born to women who receive partial antenatal care, and 15.2 percent of low birth weight babies are born to the women who receive full antenatal care. Sex of the baby, 18.1 percent of female babies and 14 percent of male babies are born with low birth weight.

In high fertility states Age of the mother increase the percentage of low birth weight also decreases. Women with severe and moderate anemia level has 34.1 percent of babies born with low birth weight than the non anemic women that is the percent of low birth in them is 23.6.The reason for high anemia level may be due nutritional level of mother, not taking the iron folic tablets. Women with low BMI level has higher percentage of low birth weight babies that is 29.8 percent than the women with higher BMI level and the percentage of low birth weight babies is 19.8.Women who do not seek any antenatal care has higher percentage of giving birth to low birth weight babies and their percentage is 39.5. Those women who seek partial antenatal care have 27.3 percent of low birth weight babies. Women who seek full antenatal care have less percentage of low birth weight babies that is 24.2. 28.8 percent of low birth weights are found among the female babies and 23.6 percent of low birth weight among the male babies.

Table 3 depicts the trend in low birth weight babies from 1992-2006. In the *low fertility states* during 1992-93, the percentage of low birth babies for Andhra Pradesh were 26.5, declined to 18.6 percent in 1998-1999 and increased to 28.3 percent in 2005-06. In Kerala, the percentage of low birth weight babies was 17.2 in 1992-93, reduced to 16.4 in 1998-99, but increased drastically to 24.7 in 2005-06. However, in Tamil Nadu, gradual decrease in low birth weight babies is noticed. In this state, during 1992-93 the percentage of low birth weight babies was 22.1, declined to 16.9 percent 1998-99 and again declined to 15.6 percent in 2005-06. In almost all the selected *high fertility states,* except Bihar gradual decline in low birth weight babies is noticed over the last 15 years. Bihar recorded 23.2 percent of low birth weight babies in 1992-93, increased to 24.8 percent in 1998-99 and again increased to 27.2 in 2005-06. In 1992-93 the percentage of low birth weight babies for Madhya Pradesh was 39.6, in 1998-99 the percentage declined to 33.8 percent and in 2005-06 the percentage declined further to 23.7 percent. In Rajasthan 52.3 percent of low birth weight babies was in 1992-93, declined notably in 1998-99 (31.7 percent) and a steep decline in 2005-06 (15.2 percent). In Uttar Pradesh, during 1992-93 the percentage of low birth weight babies was 31.6 percent, decreased to 37.4 percent in 1998-99 and in the year 2005-06 the percentage again reduced to 17 percent. At the national level, the percentage of low birth weight declined from 1992-93 (25.2 percent) to 1998-99 (22.9 percent) and declined further in 2005-06 (20.9 percent). Figure 1 gives the graphical representation of Table 3.

Table 4 portrays the results from the logistic regression with respect to three different models for the low fertility states.

Model 1: It describes that women among SC/ST are less likely to give birth to low birth weight babies. As educational level of women increases, they are less likely to give birth to low birth weight babies. Women belonging to middle category in Wealth index have lesser chances of giving birth to low birth weight babies. A rural woman has higher chance of giving birth to low birth weight babies.

Model 2: Women suffering from any kind of the pregnancy complications are more likely to give birth to low birth weight babies. Mild level of anemia among women has less chances of giving birth to low birth weight babies. Obese that is women with BMI greater than or equal to 25 kg/m^2 are more likely to give birth to low birth weight baby may be due to food habits, living style etc. Women who utilize partial antenatal care are less likely to giving birth to low birth weight babies. Female babies have less chance of being born with low birth weight.

Model 3: Women among SC/ST category have higher chance of giving birth to low birth weight babies. As educational level of women increases, they are less likely to give birth to low birth weight babies. Women belonging to middle category in Wealth index have less chances of giving birth to low birth weight babies. A rural woman has higher chance of giving birth to low birth weight babies. Women suffering from any kind of the pregnancy complications are more likely to give birth to low birth weight babies. Mild level of anemia among women has less chances of giving birth to low birth weight babies. As the body mass index (BMI) of women increases, she has higher chance of giving birth to low birth weight babies, may be due to food style that is eating junk food. A woman who utilizes partial antenatal care has less chance of giving birth to low birth weight babies. Female babies are

less chance of being born with low birth weight. Among all the three models, model one the good fit.

Table 5 explains the logistic regression with respect to three different models for the high fertility states. Model 1: As educational level of women increases, they are less likely to give birth to low birth weight babies. Women belonging to middle category in Wealth index have less chances of giving birth to low birth weight babies. Women in rural area are more likely to give birth to low birth babies.
Model 2: Mild level of anemia among women has less chances of giving birth to low birth weight babies. Women with BMI greater than 25kg/m^2 is called as obesity, they have higher chances of giving birth to low birth weight babies may be due to the biological functioning of their body, life style, food habits. A woman receiving partial antenatal care has less chance of giving birth to low birth weight babies. Female babies have less chance of being born with low birth weight.
Model 3: Women among SC/ST are more likely to give birth to low birth weight babies. As educational level of women increases, they are less likely to give birth to low birth weight babies. Women suffering from any kind of the pregnancy complications are more likely to give birth to low birth weight babies. Mild level of anemia among women has lesser chances of giving birth to low birth weight babies. Women with high level of BMI have higher chance of giving low birth weight babies. Women receiving partial antenatal care are less likely to give birth to low birth weight babies. Female babies are less likely to be born with low birth weight. Among all the three models, model three is the good fit.

Conclusion

Reporting of birth weights are low in the high fertility states, than the low fertility states. Some of the low fertility states like Andhra Pradesh and Kerala have high percentage of low birth weight babies in 2005-2006 as compared to earlier years. In almost all the selected high fertility states, except Bihar, gradual decline in low birth weight babies is noticed over the last 15 years. Bihar notes higher percentage of low birth weight babies in 2005-06 than the earlier periods. In low fertility states, illiterate women, women belonging to poor and poorest category of wealth index, with severe/moderate anemia level ,with BMI greater than or equal to 25kg/m^2, receiving no antenatal care, suffering from any pregnancy complications have higher chance of giving birth to low birth weight babies. Interestingly the female babies are less likely to be born with low birth weight compared to their male counterpart. Such findings are also found in other studies (Debbie et al. 2002) the reason may be because of growth trajectories differ between males and females, with male fetus average growth rate is faster than female fetus. In high fertility states also almost the same set of variables influence the incidence of low birth weight babies.

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Table 1. Percentage of babies with low birth weight by socio-economic characteristics of their mothers in the selected low fertility and high fertility states in India, 2005-2006.

Socio-economic characteristics	*Low fertility states*	*High fertility states*
Religion		
Hindu	16.8	25.5
Others	14.0	26.7
Caste		
SC/ST	21.3	31.3
Others	14.7	24.6
Education of women		
No education	21.2	32.3
Primary	18.5	29.0
Secondary	15.4	24.2
Higher	9.0	18.6
Wealth Index		
Poor & Poorest	21.4	30.7
Middle	18.5	30.7
Rich & Richest	10.7	21.4
Occupation of women		
Not working	15.3	25.2
Non agricultural work	15.6	24.8
Agricultural work	22.3	31.2
Place of residence		
Urban	13.1	24.4
Rural	19.7	28.7
Exposure to mass media		
No exposure	21.4	34.4
Partial exposure	16.3	26.2
Full exposure	14.5	22.2

Note:

Low fertility states (TFR<2.1) include Andhra Pradesh, Kerala and Tamil Nadu

High fertility states (TFR>3.0) include Bihar, Madhya Pradesh, Rajasthan and Uttar Pradesh

Table 2. Percentage of babies with low birth weight by bio-demographic characteristics of their mothers in the selected low fertility and high fertility states in India, 2005-2006.

Bio-Demographic Variables	*Low fertility states*	*High fertility states*
Age at first birth		
< 20 years	17.3	27.7
20-29 years	15.1	24.0
30 49 years	11.1	19.4
Pregnancy complications		
No complications	14.7	26.0
Any complications	17.2	25.5
Anemia level		
Severe & moderate	22.1	34.1
Mild	15.5	25.6
Non Anemic	14.9	23.6
Birth Order		
BO/1	14.8	27.7
BO/2-3	16.1	23.6
BO/4+	20.4	27.2
BMI		
< 18.4 kg/m^2	21.0	29.8
18.5-24.8 kg/m^2	16.2	25.7
> 25 kg/m^2	11.9	19.9
ANC utilization		
No ANC	41.7	39.5
Partial ANC	19.6	27.4
Full ANC	15.2	24.3
Sex of the baby		
Male	14.1	23.6
Female	18.2	28.4

Note:

Low fertility states (TFR<2.1) include Andhra Pradesh, Kerala and Tamil Nadu

High fertility states (TFR>3.0) include Bihar, Madhya Pradesh, Rajasthan and Uttar Pradesh

Table 3. Trends of newborn babies with low birth weight over time in India and the two groups of selected states, NFHS 1, NFHS 2 and NFHS 3

	1992-93	*1998-99*	*2005-06*
Low fertility states			
Andhra Pradesh	26.5	18.6	28.3
Kerala	17.2	16.4	24.7
Tamil Nadu	22.1	16.9	15.6
High fertility states			
Bihar	23.2	24.8	27.2
Madhya Pradesh	39.6	33.8	23.7
Rajasthan	52.3	31.7	15.2
Uttar Pradesh	31.6	37.4	17
India	25.2	22.9	20.9

Notes:

Low fertility states (TFR<2.1) include Andhra Pradesh, Kerala and Tamil Nadu

High fertility states (TFR>3.0) include Bihar, Madhya Pradesh, Rajasthan and Uttar Pradesh

Figure 1. Trends of newborn babies with low birth weight over time in selected states in India, NFHS 1, NFHS 2 and NFHS 3

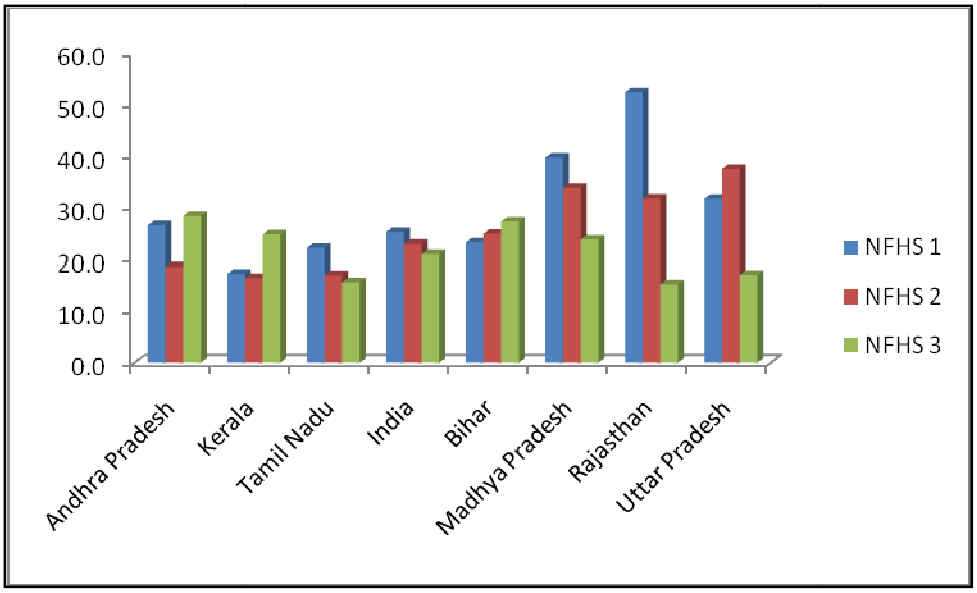

Table 4. Logistic regression analysis for low birth weight in low fertility states in India, 2005-06

Predictors of low birth weight	*Model 1*	*Model 2*	*Model 3*
	Exp(β)	Exp(β)	Exp(β)
Socio-economic characteristics			
Religion			
Others®			
Hindu	0.96	--	0.95
Caste			
Others®			
SC/ST	1.76**	--	1.74**
Education			
No education®			
Primary	0.73**	--	0.66**
Secondary	0.60**	--	0.58**
Higher	0.48**	--	0.49**
Wealth Index			
Poor & Poorest®			
Middle	0.44***	--	0.37**
Rich & Richer	0.37	--	0.24
Occupation of women			
Not working®			
Non agricultural work	1.01	--	1.03
Agricultural work	1.00	--	0.95
Place of Residence			
Urban®			
Rural	1.68**	--	1.73***
Mass Media			
No exposure®			
Partial exposure	1.06	--	1.13
Full exposure	1.00	--	0.97
Bio-demographic characteristics			
Age at first birth			
< 20 years®			
20-29 years	--	1.25	0.96
30-49 years	--	1.21	1.07
Pregnancy Complication			
No complication®			
Any complication	--	1.80**	1.82*
Anemia level			
Sever & moderate®			
Mild	--	0.94**	0.90*
Non anemic	--	0.98	0.90
Birth Order			
One®	--		
2-3	_	0.72	0.80
4 and above	--	0.81	0.87
Birth Interval			
Less than 2 years®	--		
Greater than 2 years	--	1.02	1.04

BMI			
< 18.4 kg/m2®	--		
18.5-24.9 kg/m2	--	0.78	0.33
>=25 kg/m2	--	0.39**	0.28*
Antenatal care			
No ANC®	--		
Partial ANC	--	0.32**	0.76**
Full ANC	--	0.30	0.24
Sex of the baby			
Male®	--		
Female	--	0.71***	0.72***
-2log likelihood	2152.781	2573.977	2450.669
Constant	0.28	0.17	0.19

Notes: Low fertility states (TFR<2.1) include Andhra Pradesh, Kerala and Tamil Nadu

Dependent variable is low birth weight (1=Yes, 0=No)

® Reference category

*** Significant at 1% level of significance, ** Significant at 5% level of significance,

* Significant at 10% level of significance.

Table 5. Logistic regression analysis for low birth weight in high fertility states in India, 2005-06

Predictors of low birth weight	***Model 1***	***Model 2***	***Model 3***
	Exp(β)	Exp(β)	Exp(β)
Socio-economic characteristics			
Religion			
Others®			
Hindu	1.06	--	1.13
Caste			
Others®			
SC/ST	1.82**	--	1.85**
Education			
No education®			
Primary	0.59**	--	0.67**
Secondary	0.51**	--	0.61**
Higher	0.30	--	0.32
Wealth Index			
Poor & Poorest®			
Middle	0.30*	--	0.11
Rich & Richer	0.12	--	0.28
Occupation of women			
Not working®			
Non agricultural work	0.98	--	1.01
Agricultural work	0.91	--	0.93
Place of Residence			
Urban®			

Rural	1.10**	--	1.09
Mass Media			
No exposure®			
Partial exposure	1.28	--	1.28
Full exposure	0.99	--	0.96
Bio-demographic characteristics			
Age at first birth			
< 20 years®			
20-29 years	--	1.65	1.33
30-49 years	--	1.50	1.47
Pregnancy Complication			
No complication®			
Any complication	--	0.96	1.02*
Anemia level			
Sever & moderate®			
Mild	--	0.55***	0.46**
Non anemic	--	0.07	0.03
Birth Order			
One®	--		
BO/2-3	--		
BO/4+	--	1.36	1.15
Birth Interval		0.99	1.64**
Less than 2 years®	--		
Greater than 2 years	--	0.77	0.79
BMI			
< 18.4 kg/m2®	--		
18.5-24.9 kg/m2	--		
>=25 kg/m2	--	0.60	0.29
Antenatal care		0.32***	0.15
No ANC®	--		
Partial ANC	--		
Full ANC	--	0.67	0.46**
Sex of the child		0.04	0.03
Male®	--		
Female	--	0.77**	0.78**
-2log likelihood	2152.781	2077.481	2040.126
Constant	3.85	0.17	0.15

Notes: Low fertility states (TFR<2.1) include Andhra Pradesh, Kerala and Tamil Nadu

Dependent variable is low birth weight (1=Yes, 0=No)

® Reference category

*** Significant at 1% level of significance,

** Significant at 5% level of significance,

* Significant at 10% level of significance.