Determinants of Low Birth Weight a Cross Sectional Study: In Case of Pakistan

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Abstract

This study investigates the impact of different independent factors on birth weight of infant. The Demographic and Health Survey of Pakistan (PDHS) 2014 data are used for empirical analysis. Binomial Logit Regression is employed for analysis. The analysis revealed the significant relationship of birth weight with mother's education; Mother's working status, wealth index of family, gender of child, Place of residence, age of mother at first birth with birth weight of infant. The analysis also revealed that birth-interval, birth order and institutional place of delivery reduce the birth weight children. The male children are more likely to be suffering of low birth weight as compare to female children. As far as mother's education level, her employment and wealth status increases the risk of low birth weight decreases. It has important policy implications that at least mother's education should be part of the education policy of Pakistan. The proper medical facilities should be provided at rural areas to decrease the risk of low birth weight and child mortality as well. From the policy perspective the education on birth order and birth interval should be arranged for awareness of parents. For the long-run the socioeconomic status of the household expressed by wealth index is needed.

Key words: Birth weight, infant, wealth index, Birth Interval and logistic model.

1. Introduction

The study aimed at identifying and quantifying determinants of low birth weight (LBW). LBW is a public health problem linked to a wide range of possible predictors, sometimes those are difficult to handle. Despite efforts to decrease the proportion of newborns with LBW, success has been quite limited and the problem persists in both developing and developed countries21.

There are a number of studies around the world done on this subject by using different methodologies. Either they evaluate the effects of the factors in isolation through cross tabulations or, utilizing statistical techniques to see the individual factors in presence of others. More than 20 million infants worldwide representing 15.5 percent of all births are born with low birth-weight (LBW), 95.6 percent of them born in developing countries. In addition to its impact on infant mortality, LBW has been associated with higher probabilities of infection, malnutrition and handicapped conditions during childhood (including cerebral palsy), mental deficiencies and problems related to behavior and learning during childhood4,5. Children who survive LBW have a higher incidence of diseases, retardation in cognitive development and undernourishment. There is also evidence that LBW or it is determinant factors are associated with a predisposition to higher rates of diabetes, cardiac diseases and other future chronic health problems6, 7. In developing countries, there are more babies with poorer growth having the risk of more diabetic, hypertensive and coronary heart disease patients. Moreover with the demographic transition through increased life expectancy at birth, these countries are going to face more burdens of chronic diseases. Some researchers consider that health, therefore, may be an important determinant of opportunities in life and this process termed 'selection by health', and suggest that health 'selects' people in different social strata. According to World Health Organization (WHO) the *According to WHO birth weight* of less than 2500 grams is considered as low birth. The existence of serious issue of low birth weight among urban and especially rural areas of Pakistan. Information on birth weight or size at birth is important for the design and implementation of public health programs aimed at reducing neonatal and infant mortality. A child's birth weight or size not only indicates the child's vulnerability to the risk of childhood illnesses but also defines the child's chances of survival.

Table 1

Percent distribution of all live births by size of child at birth					Birth with reported birth weight		
Very small	Smaller than average	Average or larger	Total		Number of births	Percentage less than 2.5 kg	Number of births
3.6	15.7	80.3	100.0		11.977	25.0	1,458

The table 1 given above presents information on children's weight and size at birth according to background characteristics. This is not surprising given that the majority of births do not take place in a health facility and children are less likely to be weighed at birth in a non-institutional setting. Among children born in the five years before the survey with a reported

birth weight, one-fourth was of low birth weight (less than 2.5 kg). There is visible variation in the percentage of children of low birth weight by background. Only 4 percent of children were reported to be very small at birth, and 16 percent were reported to be smaller than average. On the other hand, 80 percent of children were reported to be average or larger in size.

Objects of the study

The literature concerns with different determinants of low birth weight of infants. The adverse effects appear to be stronger on economy of Pakistan, where availability of human capital declines due to disability of such low birth infants in adult age. The major objectives of the study are birth weight of child, maternal and child health, women's and children's nutritional status, women's empowerment, and importance of prenatal care and effects of prenatal care on the health of mother and child. The survey was designed with the broad objective of providing policymakers with information to monitor and evaluate programmatic interventions based on empirical evidence. The specific objectives of the survey are to:

• collect high-quality data on topics such as fertility levels maternal and child health, infant (and especially neonatal) mortality levels, awareness prenatal care and other indicators related to birth weight of child

• investigates medical and socioeconomic factors and information to address the evaluation needs of health and family planning programs for evidence-based planning

• provide guidelines to program managers and policymakers that will allow them to effectively plan the health policies for improvement in birth weight of children.

Results bases on social socioeconomic factors effecting the birth weight of child, on basis of wealth index, ethnic difference, religious factor, mother's education and mother's employment, place of delivery of baby, birth order, birth interval, household size and gender of child.

2. Literature Review

There's a long debate on the determinants of low birth weight in economics literature. In economics literature many researchers have offered vast empirical and theoretical work to certify their particular nominated models. According to the studies which I have reviewed these variables are main determinants of low birth weight.

2.1 Wealth index

Gould and LeRoy (1988) Median Family Income (MFI) method refers to a range of income from $ 10000, $ 28000 to $30000, and $30000 to $34000 and above. Evidences proved that low birth weight has curvilinear relationship with median family income and the affluence in the median family income has an association with birth weight only a minimal. A transformation if done in MFI produces a curved shape regression line. In the result of regression 82 percent variance in percentage of low birth weight in black infants and 77 percent in white infants occurs due to income. Studies show that in area of maximum income the racial factor for low birth weight exist due to inadequate prenatal care. Evidence and research prove that white mothers with MFI are an independent risk predictor, in black infant's case interaction of MFI with prenatal care and maternal age was observed. Some planned efforts and interventions needed for improvement in prenatal outcomes to improve the health of infants, or rise in family income (Gould and LeRoy, 1988). Frimmel and Pruckner (2014) evidences show that family's economic status positively impact on the risk low birth weight. Khatun and Rahman (2008) a chi square test shows a significant relationship between birth weight and family per head yearly income. Sebayang et al. (2012) Evidence shows that the babies born at poor or very poor houses were facing 32 percent and 44 percent more chances to be LBW respectively . Kader and Perera (2014) Pearson's chi-square test show the significance relationship among wealth status of mother during pregnancy and birth weight of infant. Hirve and Ganatra (1994) evidences show a significant relationship among birth weight of infant and income level of mother (high, medium or low). Danielzik et al. (2004) evidences show that families who have better social or wealth status have significant chances to own a normal or over weight infant. (Behrman and Rosenzweig, 2004) evidences show the correlation between income of family and birth weight of infant. Shiono et al. (1997) evidences show that ethnic group is significantly associated with wealth status of family.

2.2 Racial Differences

Percentage of individual racial group of white and black infant differs due to inadequate care and pre natal care. For teen age and adult Black and white mothers Logistic equation shows that an inadequate care provided to black teenagers / adults carry risk of Low birth weight is 11.7 percent. It was 12.8 percent in teenage white mothers and 15.8 percent in adult mothers. Research suggests that gap in socioeconomically advantage either less or more and proper prenatal care, will reduce the risk of Low birth weight in white and black infants, in teenage mothers (Read for more Gould and LeRoy, 1988). Reichman et al. (2008) evidences show that Foreign Born Mexican Mothers (FBMO) were carrying less percentage to have an infant with

LBW, that was 5.4 percent to 5.8 percent, the ratio was comparatively more in non-Hispanic mothers with percentage of 12.4 percent, and the ratio of LBW infant in non-Hispanic white mothers was 13.5 percent. Crawford et al. (2010) evidences show that Asian babies were found 290 grams lighter as compare to white babies, and black babies were 160 grams lighter as compare to white babies. Reichman et al. (2008) evidences show that the least age percentage was found among FBM mothers e.g. up to 20 years of age who gave birth to an infant with LBW, whereas it was more than 35 years in other races. Abrevaya (2002) evidences show that U.S Born Mexican Origin Mothers had 60 percent lower odds to have an infant with LBW, this ratio is 57 percent in Non-Hispanic white Mothers (NHW) and this difference was not statistically significant in NHW mothers. Shiono et al. (1997) evidences show that ethnic group is significantly associated with racial factor. Shiono et al. (1997) evidences further show that Black American infants were found 236 grams lighter than White American infants. Steer et al. (1995) evidences show that in white mothers the mean of birth weight rises as far as the concentration of hemoglobin in blood falls, where lowest measure of hemoglobin concentration was more than 145 Grams per Deciliter (gm/dl), evidences further show that in some other there was no significant relationship between ethnic groups like in Pakistanis, Indians, Afro Caribbean the concentration of hemoglobin and birth weight of infant. Naeye and Peters (1982) evidences show that there is significant association between birth weight of infant and nature of mother's job and if she have also a child at home (in case of white mothers).

2.3 Micronutrients during pregnancy

See for more Rao et al. (2001) using the collected samples from lighter and thinner women, using green leafy vegetables and fruits as they are enrich source of vitamin c, iron and other nutrients. In multivariable log binomial regression shows a significant association between these nutrients and birth weight of infants. Evidences show the reduction in risk of Low birth weight for those women who were taking nutrients enrich food and supplements. Janjua et al. (2009) evidences show that vitamin c intake was significantly associated with birth weight, where normal range of vitamin c in body of pregnant woman should be more than 208.7 mg/d (1mg = 0.01 kg / m). Breeze et al. (2001) evidences show that in developing countries where mothers were not able to afford the necessary micronutrient were unable to give birth to healthy child . Sebayang et al. (2012) evidences show that if the energy enrich food / Biscuits were given to mothers which rise the birth weight up to 136g, evidences further show 39 percent increase in mean of birth weight was due to nutrient enrich food intake (Hutter, 1996). Kader

and Perera (2014) Pearson's chi-square test show the significance relationship among nutritional level of mother during pregnancy and birth weight of infant.

2.4 Environmental pollutions

Mishra et al. (2005) evidences has proved Pollution in environment and its hazards, effect the health of mother and her infant too. Presence of Lead in air, Smoking during pregnancy, working at stove place, history of acute respiratory track, high blood pressure and bio mass fuel, but none of these were found significant. Han et al. (2000), Abrevaya (2002) and Goldman et al. (1985) evidences show that the mothers who were living at polluted surroundings were giving birth to an effected infant with birth weight 80 grams less than normal birth weight of infants which is 2500 grams. Bobak (2000) evidences show that Low birth Weight (LBW) of infant is significantly associated with Sulphurdioxide in air. Goldman et al. (1985) evidences show that mother's age and expose of infant to pollution were positively correlated with health of infant.

2.5 Marital status of mother

Frimmel and Pruckner (2014) evidence shows positive effects of marital status on birth weight of infant. It is clear through evidences that marital status of mother helps to improve the child's health status, by reducing the mental stress, social instability of mother etc. (Hobel and Culhane, 2003). Facts prove that birth weight of infant of married mother is significantly better than the unmarried mothers (Chapman and Guven, 2010) . In the OLS specifications it was observed that birth weight of infants born to married mothers on average 5.5 dekagram (1dekagram = 10 grams) more than, infant born to unmarried mothers. If mother is unmarried, birth weight of infant would highly significantly coefficient of 4.9 dekagrams. If mother getting divorce during pregnancy will reduce birth weight of infant up to 7.9 dekagrams (Weiss and Willis, 1985). Sabatini (2014) the study shows that married people live a happy life as compare to unmarried, evidences Prove that happiness have an indirect and positive effect on health and birth weight. de Almeida LamarcaII et al. (2005) evidences show a significant relationship among LBW and marital status of mother e.g. married or divorced. Dearden et al. (2006) evidences show that huge percentage e.g. 47 percent in black mothers were found alone (either divorced or unmarried mothers) this ratio was only 26 percent in all other groups e.g. 13 percent in white mothers and 0nly 5 percent in Asian mothers. SEIDMAN et al. (1989) evidences show that birth weight declines up to 82.6 grams if mother is unmarried. Reichman et al. (2008) evidences show that in non-Hispanic parents multiple partner fertility was observed. Shiono et

al. (1997) evidences show that ethnic group is significantly associated with marital status of mother.

2.6 Medical expenses on low birth weight children

McIntire et al. (1999) Low birth weight infants need medical facilities more than normal weight infants; such children carry more chances of infant mortality. Evidences prove the negative effects of health and education.

2.7 Consequences of early age marry

By mother child care initiative at Austria, that provides regular prenatal care to mothers, Special health funds were specified for that purpose. Dahl (2010) Study shows 31 percent more chances to live in state of poverty if it is early age marry. Evidences show the inverse impact of mother's age, as mother age increases birth weight increases as well. Evidences prove that increase in mother age from 20 to 23 years and so forth birth weight of new born increases. New born boys are significantly 14 dekagrams Heavier than new born girls. And twins are lighter more than one kg as compare to single birth.

2.8 Place of residence

An OLS regression shows that the place of mother's residence is 0.10q (quartile) insignificant, but as far as significance of place of mother's residence decreases baby birth weight by 2.5 dekagrams. Ethnic background of mother may affect the birth weight on infants (Frimmel and Pruckner, 2014). Kader and Perera (2014) Pearson's chi-square test show the significance relationship among living standard of mother during pregnancy and birth weight of infant. de Almeida LamarcaII et al. (2005) evidences show that Prevalence of inadequate housing was significantly associated with LBW. Shiono et al. (1997) evidences show that ethnic group is significantly associated with residential status of Parents either living at Private residences or Public residences. Nahar et al. (1998) evidences show that in different types of residential localities were significantly affecting the birth weight of infants but in different ratios birth weight was different too, in Urban slum area 36.8 percent of infants were under normal range of weight, the ratio was 20.9 percent in rural area and lowest in urban affluent group with 14.9 percent

2.9 Mother's education

Chevalier and O'Sullivan (2007) evidences show that mother education can effect potentially to the birth weight of infant. Low birth weight of infant may improve if mother is educated. A correlation between mother education and birth weight was found. Evidences further show the Impact of investment on mother education in shape of improvement in birth weight of infant, one year increase in mother education may cause improvement of 75 grams in birth weight of infant or vice versa (Acevedo-Garcia et al., 2005). Abrevaya (2002) effects of birth weight were observed not only on family but society too, evidences show that each additional gram in birth weight effect economy heavily by $6 to $20, and additional cost of $1500 for education in case of infant with low birth weight. But a negative correlation was found in case of birth weight of infant and mother health, low investment on mother health lead to adverse outcomes in postnatal environment, and it was found due to unobservable biological processes, some genetic and family effects were found which effect mortality rate of infant too Wilcox and Skjaerven (1992). Evidences prove that increase in educational level of mother birth weight increases as 3.7, 6.0 8.0 9.3 dekagrams respectively. Chevalier and O'Sullivan (2007) evidences show that 45 people of less educated mothers gave birth at home , only 25 people of university educated mothers did so, which was found risk for both mother and infant. Khatun and Rahman (2008) it is clear through evidences that mother's education and birth weight are significantly related with each other. Evidences show that if mother is educated up to high school level the odd of LBW decreases up to 13 percent , education of women or their husbands can be exchange but it bring the odd ratio up to 2 percent only , but the it increases as each year of educational level increases Sebayang et al. (2012). Kader and Perera (2014) through evidences that the significance relationship among educational level of mother during pregnancy and birth weight of infant is clear, evidences further explain that women with primary education have 62 percent chances to give birth to a low birth infant , where chi square gives its p value less than 0.0001. Agarwal et al. (2011) evidences show that 97 percent risk of LBW in infant declines if mother is educated even up to graduation level. Crawford et al. (2010) evidences show that parental education become insignificant except for women with level of 4/5 qualifications, educational impacts significantly on gestational period. McCrary and Royer (2006) evidences show that infant health correlate with mother's schooling. Dearden et al. (2006) evidences show that White parents were more educated than all other groups. Seidman et al. (1989) evidences show that a year increase in education of mother will increase the birth weight up to 3.6 grams. Goldman et al. (1985) evidences show that those mothers who were educated up to high school level were carrying less chance of infants exposed to polluted surroundings as compare to those mothers who were educated less than high school level. Bobak (2000) evidences show positive

correlation among mother's education her exposure to the Nitric Oxide (NO) and birth weight of infant. Reichman et al. (2008) evidences show that in Foreign born Mexican parents who were least educated were more likely to give birth to an infant with LBW. Shiono et al. (1997) evidences show that ethnic group is significantly associated with education of mothers. (Nahar et al. (1998) evidences show that mother education is significantly associated with birth weight of the infant, it further shows that chances of abnormal birth weight decreases as far as the education of mother increases. Evidences show that more education will reward in the form of more budget constraint direct or indirect increase in income, which will help the mother for better health status. It will not only improve the birth weight of child but also effect positively to the reproductive health of mother more budget she will able to allocate for more children , more education will lead them towards more improved health measurements in shape of latest technology available (Cutler and Lleras-Muney, 2006) .

2.10 Employment status of parents

Frimmel and Pruckner (2014) Evidences prove that employment status of parents effect the birth weight. Evidences show that the mothers who were working hard during pregnancy were facing 78.0 percent proportion of LBW infant, but the mother with moderate work or employment status were found near 30.03 percent proportion to give birth to an infant with LBW, and it was 22.5 percent in women with less or even no hard work during pregnancy. Naeye and Peters (1982) evidences show that there were less chances for an infant to suffer of LBW if the mother is employed somewhere and nature of job is a sitting type. Naeye and Peters (1982) evidences show that mothers working outside home after 28^{th} week of gestational period were significantly carrying more chances for their infants to suffer with issue of low birth weight.

2.11 Smoking of Parents

Chevalier and O'Sullivan (2007) evidences show negative consequences of smoking on birth weight of infant, Evidences further show that , smoking during pregnancy decreases birth weight up to 160 grams. Sebayang et al. (2012) evidences show no significant relationship between smoking of mother during pregnancy and birth weight of infant to be born. Agarwal et al. (2011) evidences show 58.5 percent mothers using tobacco gave birth to an infant with LBW, it further shows a significant relationship with (p value $<$ 0.0000) among birth weight and use of tobacco by mothers. de Almeida LamarcaII et al. (2005) evidences show a significant association among LBW along with Preterm LBW and smoking habit of mother.

Crawford et al. (2010) evidences show that about 34 percent of mothers smoked before pregnancy an 27 percent during pregnancy, evidences further show that mothers of Asian children only 5 percent smoke before and 3 percent during pregnancy, in black women the ratio was 21 percent before and 17 percent smoke during pregnancy, evidences further show that smoking during pregnancy does not impact on gestational length, but effect negatively affects the birth weight, and shift mean birth weight downwards. Silles (2012) evidences show that smoking during pregnancy reduces birth weight up to 100 – 200 grams, evidences further show a correlation with inadequate nutritional status , evidences show a significant difference among women who smoke during pregnancy or before pregnancy. Silles (2012) evidences show that smoking is statistically significant to the birth weight but impact negatively. Danielzik et al. (2004) evidences show that parents who smoke more cigarette per day have more chances to have an infant with low birth weight, but parents who smoke less have chances to have a normal baby. Dearden et al. (2006) evidences show that smoking behavior differs in different times before pregnancy and during pregnancy so there affects are different in different times. Evidences further show that 24 percent mothers who smoked before pregnancy and only 27 percent smoked during pregnancy, some of them smoke fewer cigarettes per day, some of them were chain smoker, evidences show that among Asian mothers only 5 percent smoke before pregnancy and 3 percent during pregnancy, but mothers of black children 21 percent smoke before pregnancy and 17 percent during pregnancy. Evidences further show that average number of cigarette smoked by women before pregnancy was 12.6 per day, whereas the average number of cigarette smoked by women during pregnancy was 7.5 per day, and mothers in such smoking pattern during or before pregnancy gave birth to an infant whose birth weight was 140 grams less than average birth weight of any normal infant after the birth. SEIDMAN et al. (1989) evidences show that mother's one cigarette a day decreases the birth weight up to 5.2 grams. Goldman et al. (1985) evidences show that if mother smoke a cigarette a day it decreases birth weight up to 55 grams. Abrevaya (2002) evidences show that Non-Hispanic white mothers were more likely to use alcohol and tobacco. Shiono et al. (1997) evidences show that ethnic group is significantly associated with smoking of parents. Deshmukh et al. (1998) evidences show that smoking of parents and use of tobacco in any other form is significantly associated with low birth weight of infant.

2.12 Use of Alcohol

Crawford et al. (2010) evidences show that 37 percent white mothers drunk Alcohol during pregnancy comparatively to those 2 percent of Asian mothers, evidences further show that use

of alcohol during pregnancy prolong it for one day. Dearden et al. (2006) evidences show that 37 percent of white mothers drank alcohol this percentage was only 2 percent in Asian mothers, 17 percent of black mothers use alcohol during pregnancy and only 30 percent of all other ethnic groups do so.

2.13 Fetal Growth

Behrman and Rosenzweig (2004) evidences show that fetal growth has positive effect on birth weight of infant. Sebire et al. (2001) evidences show that 50 percent of all miscarriages were due to misinformation and health measures taken during pregnancy. Abrevaya (2002) evidences show that foetal growth is significantly associated with availability of nutrition and food to mother. Sebayang et al. (2012) evidences further explain that previous miscarriage ultimately affects the birth weight of next infant to be born. Behrman and Rosenzweig (2004) evidences show that increase in intrauterine nutrient positively effects birth weight of infant. Barker et al. (2001) evidences show that, the babies have low birth weight carry more chances of chronic diseases like coronary heart problem and hypertension in early days after birth (McIntire et al., 1999). Silles (2012) evidences show that correlation between birth weight and infant health persist even when unobserved fixed effects have been controlled, evidences show a true casual effect on birth weight in cross sectional representation

2.14 Mother's Body Mass Index (BMI)

Chevalier and O'Sullivan (2007) Evidences show a nonlinear effect of BMI on child's birth weight. Osman et al. (2000) Evidences show a negative correlation between BMI of mother and birth weight of infant, but after a single visit to prenatal care provider. Kader and Perera (2014) Pearson's chi-square test show the significance relationship among BMI level of mother during pregnancy and birth weight of infant, evidences further explain that the odd of low birth weight of infant was 49 percent more if BMI is less than 18.5 (where standard BMI was taken by height and weight of mother). Hirve and Ganatra (1994) evidences show that a woman with weight below 40 kg height less than 145cm have more chances to give birth to an infant with low birth weight. Agarwal et al. (2011) evidences show a significant relationship among LBW and BMI with (p value < 0.0000) the chances of LBW in mothers with height less than 150cm was 65.6 percent, and it was 34.40 percent in mothers with height more or equal to 150cm, evidences show BMI is a ratio of weight and height so women with less than 50 kg weight were carrying 76.1 percent chances to give birth to an infant with LBW. de Almeida LamarcaII et al. (2005) evidences show a positive significance among low birth weight and mother's body

mass index. Crawford et al. (2010) evidences show that Asian mothers were found 5cm shorter than other ethnic groups, evidences further prove that on average fathers of white children were 5cm taller than the father of other racial groups, it further show that black mothers were found heavier than other ethnic groups, evidences further show that the Asian mothers have average weight lowest than others, evidences further show that the Asian mothers were found 10 percent underweight where other groups were 10 percent underweight. Evidences show that the black mothers were found 40 percent over weight. Behrman and Rosenzweig (2004) evidences show the inverse relation between BMI and family back ground, evidences further show the positive relationship among adult's BMI and fetal growth. Evidences further show that due to better nutrient adult height increases up to 0.6 inches. Seidman et al. (1989) evidences show that 1000 grams increase or decrease in mother's body mass index will effect birth weight of infant up to 26.6 grams. Shiono et al. (1997) evidences show that ethnic group is significantly associated with mother's body mass index of mother and low birth weight infant. Deshmukh et al. (1998) evidences show that LBW of infant is significantly associated with BMI of mother. Crawford et al. (2010) evidences show that mothers of different ethnic groups were underweight before pregnancy. Silles (2012) evidences show that taller mother have babies with normal weight due to intrauterine growth either by environmental factor or by genetic effect. Dearden et al. (2006) evidences show that mothers of Asian children were 5cm shorter in height than all other ethnic groups. Evidences further show that fathers of White children were 5cm taller than all other racial groups. Evidences show that Black mothers have average weight more than other racial groups, whereas Asian mothers have lowest average weight before pregnancy, whereas 40 percent of black mothers were overweight or obese before pregnancy than other racial groups.Seidman et al. (1989) evidences show that the independent variables e.g. birth weight and mother weight gain were found positively correlated. Seidman et al. (1989) evidences show that a single inch increase or decrease in mother's height will increase or decrease 12.6 grams of birth weight of child. Abrevaya (2002) evidences show that Foreign Born Mexican Mothers were carrying 16.2 percent chances to suffer of obesity, whereas this ratio was 17.7 percent in Non-Hispanic White Mothers. Deshmukh et al. (1998) evidences show that parent's height and birth weight of infant are significantly associated with each other. Crawford et al. (2010) evidences show that women who were suffering of obesity or underweight give birth to an underweight children as compare to normal weight women. Shiono et al. (1997) evidences show that ethnic group is significantly associated with obesity of mother effects LBW accordingly.

2.15 Mother's hemoglobin

Agarwal et al. (2011) evidences show the prevalence of 60.5 percent of risk of LBW in mothers with hemoglobin less than 10 gm/dl , evidences further show that mothers with hemoglobin more than 10gm/dl were facing prevalence 39.5 percent which is approximately 49 percent less than with mothers whose hemoglobin was less than 10gm/dl. It was though suggested that Hemoglobin level must be maintained properly through nutrition or by consuming healthy diet. Deshmukh et al. (1998) evidences show that LBW is significantly associated with anemia of mother.

2.16 Prenatal care

Janjua et al. (2009) Evidence shows a significant relationship among low birth weight and number of visits to prenatal care provider, but if these are less than three visits. Coria-Soto et al. (1996) evidences show that premature delivery, pre-birth mortality and LBW are outcomes of poor prenatal and antenatal care. Kader and Perera (2014) Pearson's chi-square test show the significance relationship among prenatal care visits of mother during pregnancy and birth weight of infant. Kader and Perera (2014) evidences show that less than four visits to prenatal care center was associated with low birth weight (where $p < 0.05$ for female), and male infant was protected whose p value was less than 0.001. Agarwal et al. (2011) evidences show that prevalence among women with proper antenatal care of three to four visits and no antenatal care was 29.5percent and 68.5percent respectively (Idris et al., 2000). de Almeida LamarcaII et al. (2005) evidences prove a significant relationship among LBW and prenatal care provide to mother with a (p value $<$ 0.005). Behrman and Rosenzweig (2004) evidences show that prenatal factor affects postnatal human capital investment thus due to reduction in birth weight the average wage of human capital declines. Hirve and Ganatra (1994) evidences show that tetanus immunization adversely affects the birth weight, if ignored.

2.17 Religion

Khatun and Rahman (2008) Evidences show that mother religion and birth weight of infant were found insignificant. Agarwal et al. (2011) evidences show that ratio of LBW was 58.7 percent more in Muslim women as compare to non-Muslims , it further explain the factor of religion was statistically significant (p value was $<$ 0.005). Seidman et al. (1989) evidences show that birth weight of infant decreases up to 63.6 grams if parents are non-Jews. Shiono et al. (1997) evidences show that ethnic group is significantly associated with Parent's religion and effect birth weight of infant accordingly.

2.18 Family size

Khatun and Rahman (2008) Evidences show that family size and birth weight of infant were found insignificant. Booth and Kee (2009) evidences show that family size variable has a much bigger negative effect on children's educational outcomes. With all the other interaction models, the inclusion of mother's education interaction terms does not alter the sign, magnitude and significance of the family size and birth order variables (Booth and Kee, 2009). It further show that employment status of mother is significantly associated with family size (Booth and Kee, 2009).

2.19 Birth interval

Through evidences an insignificant association with birth weight was observed with conception interval (Papiernik and Kaminski, 1974). Hirve and Ganatra (1994) evidences show that 1st or 2nd trimester and history of previous stillbirths adversely affected the risk for LBW. Lieberman et al. (1994)evidences suggest that the effect of cigarette smoking on growth retardation occurs during the third trimester of pregnancy. This is also consistent with previous work demonstrating that for babies born early in the third trimester (at 30 to 31 weeks), smoking was not associated with the occurrence of growth retardation."3 Finally, our investigation indicates that while any smoking during the third trimester is associated with an increase in undersized birth.

2.20 Mother's age at time of Marriage / first birth

Sebayang et al. (2012) age of parents was not found significant to investigate the issue of LBW. Kader and Perera (2014) evidences show that if mother is less than 20 years carry chances to suffer of anemia . Hirve and Ganatra (1994) evidences show that mother's age if less than 20 years and those who are primiparas (giving birth to first child) will carry more risk of LBW than women who had been given birth to infant in last 6 months or before. Bisai et al. (2006) evidences show the effect of mother's age on birth weight in different age groups, e.g. mothers age less than 19 years will give birth to an infant with low birth weight as compare to mother with age of 19 years or more, it further show that chances of low birth weight in infants decreases in age of 24 – 28 years, risk of LBW was 2.9 chances more in young mothers. (Agarwal et al., 2011) evidences show two age groups have more chances of low birth weight where relation of age and LBW was found statistically significant with (p value < 0.0000), it was 58.5 percent chances when mother's age was below than 20 years, and it was 48.8 percent chance of LBW in age of 30 years or more than 30 years. Seidman et al. (1989) evidences show

that one year increase or decrease in mother's age will increase or decrease 4.3 grams of birth weight accordingly. Shiono et al. (1997) evidences show that ethnic group is significantly associated with parents age, it further shows that a year increase age of White American mothers will increase 8 grams of infant's weight, whereas it was not significant in case of Black American Infants. Deshmukh et al. (1998) evidences show that mother's height is significantly associated with Low Birth Weight (LBW) of infant. Nahar et al. (1998) evidences show that mother's height was significantly associated with Low Birth Weight of infant (LBW), evidences further show that the 5% of infant suffering of LBW their mothers weight 30kg to 39kg and age of mother is 25 years to 29 years, but the situation was different in mothers with age of 15 years to 19 years 42.9% of their infant suffer of LBW issue, was lowest in mothers age between 30years to 34 years with percentage of 17.1% for infant to be under normal weight. Evidences show that mothers whose height was 126 cm to 140 cm were carrying significant chances of 47% to have an infant with LBW; the chances were 57% in women with height of 141cm to 150cm.

2.21 Gender of child

Crawford et al. (2010) evidences show that baby boys were born 0.6 days earlier than girls, evidences further show that Female babies were 120 grams lighter than male babies. Danielzik et al. (2004) evidences show that 24 percent baby girls who were overweight , their mothers were found obese , in boys the ratio was 10 percent. Dearden et al. (2006) evidences show that male babies are 120grams heavier than female babies. Seidman et al. (1989) evidences show that gender is negatively correlated with infant's birth weight in case of female infant.

2.22 Birth order

Abrevaya (2002) evidences show that order / interval of birth was significantly associated with low birth weight, It was further observed that first child was carrying 95 percent more chances of LBW as compare to second or so forth. Bisai et al. (2006) evidences show that risk of LBW decreases as far as the number of deliveries of a woman increases, the mean of different birth weight was 145 grams, evidences further show the odd ratio of 2.45 among first delivery and second or onwards. Agarwal et al. (2011) evidences show a non-significant relation among parity factor and LBW, it further show that the chances of low birth weight risk were more in first delivery with 39.1 percent but it decreases with second order with 34.9 percent, here, evidences further show that risk of LBW was more about 38.5 percent in those women whose interpregnancy period was less than two years. de Almeida LamarcaII et al. (2005) evidences

show that LBW was dominated with ratio of 8.2 percent in women with first birth and declines so forth. Crawford et al. (2010) evidences show that birth weight increases up to 76 grams after first delivery. Seidman et al. (1989) evidences show that parity factor effects the birth weight up to 19.3 grams against each year. Shiono et al. (1997) evidences show that ethnic group is significantly associated with parity factor which effects birth weight accordingly. Deshmukh et al. (1998) evidence shows that parity factor is significantly associated with low birth weight.

2.23 Immature birth

Abrevaya (2002) evidences show no relation between sex of baby and Birth Weight, In women with more education up to matriculation 36 percent chances were decreased to be LBW baby , evidences further show that women with less MUAC were carrying 13 percent more risk of LBW babies to be born, nausea was found significantly associated with preterm births.

3. Methodology and Model Specification

In linear regression model we commonly undertake that the set of X variables is use to determine the Y values. In this study the dependent variable is a binary variable that why we cannot use simple linear regression model. We are employing the binary Logit model in which we have coded the depended variable [0, 1]). The main equations of Logit model are

$$P(Y=1) = 1/1+\exp [-(\alpha + \beta 1X1 + \beta 2X2 + \ldots\ldots\ldots + \beta kXk] \quad \ldots(3.1)$$

$$\text{Logit } [p(y=1)] = \alpha + \beta 1X1 + \beta 2X2 + \ldots\ldots\ldots + \beta kXk \quad \ldots(3.2)$$

Where Logit is

$$[p(y=1)] = \log_e | p(y=1)/1-p(y=1) | \text{ i.e. Log Odds} \quad \ldots(3.3)$$

$$\text{Ln } [(p)/ (1-P)] = a + \sum bi.xi \quad \ldots(3.4)$$

Functional form

$$\text{B weight} = a + \beta 1\text{GENDER}_{ij} + \beta 2\text{M EDU}_{ij} + \beta 3\text{WEALTH}_{ij} + \beta 4\text{MIS}_{ij} + \beta 5\text{NOC}_{ij} + \beta 6\text{HHS}_{ij} + \beta 7\text{POR}_{ij} + \beta 8\text{MAFB}_{ij} + \beta 9\text{BI}_{ij} + \beta 10\text{BORD}_{ij} + \beta 11\text{INP}_{ij} + e_t$$

After estimations only these variables are significant, means that in case of Pakistan only these variables are the determinants of low birth weight. Where birth weight is the function of child's gender, mother's education, wealth index, employment status of mother, size of household, family size, place of residence, age of mother at first birth, birth interval and place of delivery.

4. Data Description

4.1 Wealth index

The wealth index is an index of household socioeconomic status. It is used due to large number of inequalities in household income. The wealth index is constructed from household characteristics (having electricity, access to sanitation facility, availability of bicycle, main roof material) and ownership of durable goods (wardrobe, table, chair or bench, watch or clock, radio, television, bicycle, sewing machine and telephone) and land ownership. DHS has divided the index into quintiles lowest to highest. The same quintiles have been included in the analysis. Vehicle explains the possibilities of emergency medical transportation.

4.2 Employment status of mother

Employment is a source of women's empowerment, where it allows them to control their earnings. But measurement of women's employment is difficult because some of them do work at different job place especially at urban areas but at rural areas the women work at their own farms which is not reported as employed women it's a case of natural unemployment. Now we have categorized the women's employment status in to two categories like women employment status is equal to one if the woman is employed somewhere and employment is equal to zero if woman is not employed or jobless even if she is working at her own farms / fields.

4.3 Household size

Number of children at home is known as family size. It is observed through studies that increase in household size increases the risk of low birth weight. It depends upon the fertility and family planning of husband and wife.

4.4 Place of residence

In the survey, the place of residence where the respondent was interviewed either urban or rural was nether respondents own categorization, on whether the sample point was located in urban or rural area. Urban areas has been classified into towns, small cities which had population of over 50,000 and big cities including capital cities and cities which had population of over one million. The rural areas were assumed to be countryside. The classification of urban and rural areas in the survey has been used in the analysis.

4.5 Age of respondent at 1st birth

The onset of childbearing has a direct bearing on fertility. Early initiation into childbearing lengthens the reproductive period, which in turn increases the chances of higher fertility.

Bearing children at a young age also entails risks to the health of the mother and the child. In the light of DHS data the median age at first birth for women age is 22.2 years.

4.6 Child's birth-order

Birth-order gives a sequence in which the child was born. Birth order calculates the difference between the current and previous birth, counting twins as one birth. Birth-order has been taken as continuous.

4.7 Place of delivery

In the Data the place of delivery has been categorized in two major areas where delivery of baby took place Rural / Urban, now we have coded some other categories like than we code it as 0 if delivery of baby took place at home, respondent's home, or at some other place, we have coded it as 1 if delivery took place at government hospital, rural health center, public sector, private clinic / health care center.

5. Results and Discussion

Through the data we try to study the impact of different variables on the birth weight of infant.

Results of wealth index in table 3 given below show that poorer wealth status of family insignificantly reduces the risk of low birth weight. But the middle wealth status of family significantly reduces the risk of birth weight. Results further explain that the richer wealth status of family significantly reduces the risk of birth weight; it is clear through results that the richest wealth status of family significantly reduces the risk of birth weight. Because it is easy for a rich family to meet the pre-birth expenses either in shape of food of pregnant woman or medical expenses of consultant / doctor or gynecologist, where poor person cannot afford these expenses therefore risk of low birth weight of children is more in people poorer wealth index.

Result shows that the increase in Mother's Education significantly decreases the risk of Low Birth Weight. Because if mother will be educated she will be aware about her health, she will be able to consult the relevant medical consultant at right time. If mother will be educated she will be able to take healthy diet which is suitable for her health during pregnancy. As far mother's education concerns it also affects the wealth index of mother and it is clear in results that better wealth status significantly decreases the risk of low birth weight.

The results of child gender indicates that if child is female then the risk of low birth weight significantly decreases as compare to male child. The physiological processes underlying the relationship between adverse birth outcome and children subsequent development

Table 5.1

Results of data				
VARIABLES	Coefficients	Odds Ratios	Std. Err	P>|Z|
Wealth Index [Poorest as reference]				
Poorer	-0.0452	0.9558	0.105	0.668
Middle	-0.238**	0.7880	0.116	0.039
Richer	-0.365***	0.6940	0.141	0.010
Richest	-0.332*	0.7174	0.188	0.077
Mother's Education (Continuous)				
	-0.0205	0.9797	0.012	0.099
Child's Gender [Male as reference]				
Female	0.161**	1.1751	0.0745	0.030
Birth Order (Continuous)				
	-0.0250	0.9754	0.0182	0.171
Birth Interval (Continuous)				
	-0.0395	0.9613	0.0816	0.628
Mother's Working Status [No as reference]				
Yes	0.101**	1.1067	0.0483	0.036
Place of Residence [Urban as reference]				
Rural	0.216**	1.2405	0.102	0.034
Number of Household Members (Continuous)				
	-0.00615	0.9939	0.00846	0.467
Mother's Age at First Birth (Continuous)				
	-0.0241**	0.9762	0.0110	0.028
Institutional Place of Delivery [No as reference]				
Yes	0.0948	1.0994	0.0805	0.239
Constant	-1.238***	0.2900	0.356	0.001
Observations	9,045			

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Results show that increase in birth order decreases the risk of low birth weight but this relationship is insignificant. Because with passage of time due to increase in age of mother chances of low birth weight increases as well, as far as number of children increases it becomes possible that mother may suffer some health disorders or complication come across her. Result show that increase in birth interval decreases the risk of low birth weight, but this relationship is insignificant. Mother's working status significantly decreases the risk of low birth weight. Because if mother is employed she will be able to afford her expenditures during pregnancy, either they are medical expenses or food expenses. But it is also explained in some studies that the birth weight of infant also depends upon the nature of mother's work, if she is working physically or outside the offices than the birth weight will be low as compare to mother who is

working at offices. Result shows that if place of residence is rural then the risk of low birth weight significantly decreases but increases as compare to urban areas. Because at urban or remote areas of residence availability of the proper medical and other necessary facilities is mostly difficult, and most of times no medical aid or first aid is available in case of any complication. Where there is no awareness about health hazards and importance of prenatal care. Where surroundings matter, either there is pollution in surrounding or an industrial area in nearby surroundings that it will surely affect the birth weight. Results show that as number of household members increases the risk of low birth weight increases, but this relationship is insignificant. The promotion of educational attainment is an important priority of policy makers. The Economics of the family suggests that family size can have an important effect on Children's educational attainment, and that there is a tradeoff between child quantity and 'Quality' (Becker (1960), Becker and Lewis, (1973), where child 'quality' is peroxide by educational outcomes. Family size is likely to reduce the per capita resources that can be spent on educational investments. Results show significant relationship among mother's age at first birth and birth weight of child, as far as mother's age increases the risk of low birth weight increases as well. The best age of mother at which there is minimum risk of low birth weight is between 20 years to 23 years as mother's age increases from 23 years risk of low birth weight increase so forth. Results show insignificant relationship between institutional birth and risk of low birth weight. As we know that delivery of baby should be handle carefully handle, and specially designed equipment's needed for this purpose, but unfortunately in our country Pakistan many people arrange delivery of baby at home that is dangerous for mother and child health but it is fetal and life risk process.

6. Conclusion and Policy recommendations

6.1 Conclusion

LBW is a public health problem linked to a wide range of possible predictors, sometimes those are difficult to handle. Despite efforts to decrease the proportion of newborns with LBW, success has been quite limited and the problem persists in both developing and developed countries. There are a number of studies around the world done on this subject by using different methodologies. Either they evaluate the effects of the factors in isolation through cross tabulations or, utilizing statistical techniques to see the individual factors in presence of others. As the study clarify that there exists serious issue of low birth weight among urban and especially rural areas of Pakistan, where the lack of awareness, education and unavailability of medical facilities are major reasons of low birth weight of children. In our rural as well as urban

areas there are serious concerns of wealth status; most of our population is living under poverty line, where people cannot afford cost of prenatal and postnatal expenses. In urban areas the environmental issues are seriously damaging the public health, though there are facilities but we can observe the conditions of over burden public hospitals, where people have no other option to move towards the private hospitals or clinic, and those who cannot afford moves towards non institutional or home delivery.

6.2 Policy recommendations

It is recommended to improve the condition of public hospitals with well-equipped and subsidies health facilities, to avoid non institutional or home delivery of children. The mother's education should be stressed for improved birth weight children. Two factors, i.e. duration of gestational period and BMI of mothers need further stress in policy formulation. The government should provide awareness about importance of prenatal care. As a policy program the prenatal care should be provided at door step to the pregnant women by rural health care programs. The low BMI of mothers requires attention for policy making in the long run. At present the mothers should be guided through mass media about the issues of birth order, birth interval, and suitable age for mother at first birth. For the short-run to the mothers during pregnancy the good nutrition and supplement food should be provided free or at subsidies prices to avoid the risk of anemia or iron deficiency in mothers and new born as well.

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