International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2016): 79.57 | Impact Factor (2017): 7.296

Analysis of Low Birth Weight of Newly Born Babies in Sunyani Municipality

D. Otoo[1], B. Asamoah Afful[2], E. Larbi[3], E. Acheampong-Wiafe[4]

[1, 2, 4]Department of Mathematics, University of Energy and Natural Resources, Sunyani

[3]Catholic University College of Ghana, Sunyani

Abstract: ***Birth weight is one of the key indicators of the health and viability of the newborn infant and a person's personality. It is desired that birth weight should be in the range of 2.5kg and 4.0kg. According to the World Health Organization (WHO) Low Birth Weight is as defined weight at birth less than 2.5kg. Low birth weight is major determinant of morbidity, mortality and disability in infancy and childhood. This is a very important indicator of a person's health status, but little information known is about its causes and effects among mothers' in Ghana. This is also risk factors for long-term impact on health outcomes in adult life. A study on some selected social and maternal factors pertaining to Low Birth Weight was conducted in Sunyani Municipal Hospital, Ghana. Records of 100 live births in a period of one year (16th January, 2016 to 29th December, 2016) were analyzed. This paper deploys singular value decomposition and multiple linear regression to identify the significant factors influencing the weight of the Low birth weight babies. The results obtained showed that all the selected maternal factors are the factors causing Low Birth Weight with mother's haemoglobin concentration level being the most significant in all cases. We also conclude that pregnant women should take in additional nutritional food to increase haemoglobin concentration to avoid Low Birth Weight.***

Keywords: Low Birth Weight, Birth weight, Haemoglobin concentration, Maternal Weight, Maternal height, Singular Value Decomposition (SVD), Multiple Linear Regression

1. Introduction

Birth weight is the single most important criterion for determining the neonatal and infant survival.

Babies with a birth weight of less than 2.5kg irrespective of the period of their gestation are termed as Low Birth Weight (LBW) babies.

In Ghana, the issue of birth weight and factors influencing it has not received the much needed attention. This should not be the case given the importance of birth weight as an indicator of an individual baby's survival and a person's personality. W.H.O and UNICEF (2006), Ghana recorded higher Low Birth Weight cases of 16% compared to the 14% for sub-Saharan Africa. Low Birth Weight babies in Ghana was 10.70% as of 2011. Its highest value over the past 18 years was 16.10% in 2003, while its lowest value was 9.10% in 2006.

The purpose of this paper is to identify the factors that contribute to Low birth weight and to suggest some intervention strategies to improve the survival of the low birth weight babies.

The study will apply Singular Value Decomposition (SVD) and Regression Model to identify significant factors associated with Low Birth Weight babies. The data was analysed using the MATLAB and R softwares.

1.1 Background of Study

Sunyani is a city and the capital town of the Brong-Ahafo Region and the Sunyani Municipal of Ghana. Sunyani had a population of 248,496 at the 2012 census.

The Sunyani Municipality covers a total land area of 506.7 Km^2. It is located at the heart of Brong-Ahafo Region lying between Latitudes $7^0 20^0 N$ and $7^0 05^0 N$ and Longitudes $2^0 30^0 W$ and $2^0 10^0 W$.

Although considerably smaller than nearby Kumasi, Sunyani is growing rapidly and has effectually engulfed the suburbs of Fiapre and Abesim, amongst others. Sunyani is a clean and well maintained city with a thriving economy. Sunyani was voted the cleanest city and settlement in Ghana for the year 2007.

The economy of Sunyani is predominantly agrarian with approximately 48% of the population engaged in agriculture production. The average rainfall is 88.99cm.

2. Literature Review

A study was conducted by (Sachin S. Mumbare et al. 2010) on Maternal risk factors associated with the term low Birth Weight at Hospital Nasik, Maharashtra. The study concludes the maternal malnutrition, inadequate antenatal care and poor weight gain during pregnancy are significant predictor for delivery of low birth weight babies.

In almost every study concerning low birth weight babies, education as a risk factor has been mentioned as an important indicator for low birth weight (Silvestrin et al., 2013, p.344). Silvestrine noted that, mothers who have less than eight years of formal education are 1.5 times more likely to have a low birth weight baby.

Fosu et al. 2013 conducted an analysis on some maternal factors causing low birth weight, namely; age, socioeconomic factors, antenatal services, residence/location (urban, rural), gestational age, hemoglobin levels, placental malfunction, weight, height, mothers' education, fetal infection, baby's sex using data from a District Hospital in the Ashanti Region of Ghana in 2013. Their results revealed that the significant factors were fetal infection residence, hemoglobin level, antenatal care and maternal age.

Mothers that have less than 12 years of education have an increased risk of delivering a low birth weight baby, while 12 or more years of education reduces that risk (Batech et al., 2013).

There is a 33% protection effect against LBW for women that have a higher education and a 9% higher probability of having a LBW child if the mother has not finished high school (Silvestrine et al., 2013). Therefore, an increase in education is vital for better access to necessary healthcare to ensure a healthy and safe delivery.

In terms of the other factors which influence birth weight, (Dearden et al. 2011) find that length of gestation is one of the most important predictors.

(Delaney et al. 2011) use a dramatic shift in public health which occurred in Ireland in the 1940s, and show that the children who benefited from improvements in early life conditions went on to be healthier and stronger adults. Almond and Currie (2011) provide a recent summary of the causal evidence.

3. Methodology

3.1 Singular Value Decomposition

In linear algebra, the singular value decomposition (SVD) is a factorization of a real or complex matrix. It is the generalization of the eigen decomposition of a positive semidefinite normal matrix (for example, a symmetric matrix with positive eigen values) to any matrix via an extension of polar decomposition. It has many useful applications in signal processing and statistics.

The singular value decomposition of a matrix A is the factorization of A into the product of three matrices $A = UDV^T$ where the columns of U and V are orthonormal and the matrix D is diagonal with positive real entries.

$\therefore A = UDV^T$ which can be fully expressed as;

$$\begin{bmatrix} A_{11} & A_{12} & \cdots & A_{1n} \\ A_{21} & A_{22} & \cdots & A_{2n} \\ \vdots & \vdots & \cdots & \vdots \\ A_{m1} & A_{m2} & \cdots & A_{mn} \end{bmatrix} = \begin{bmatrix} U_{11} & U_{12} & \cdots & U_{1n} \\ U_{21} & U_{22} & \cdots & U_{2n} \\ \vdots & \vdots & \cdots & \vdots \\ U_{m1} & U_{m2} & \cdots & U_{mn} \end{bmatrix} \begin{bmatrix} D_{11} & 0 & \cdots & 0 \\ 0 & D_{22} & \cdots & 0 \\ \vdots & \vdots & \cdots & \vdots \\ 0 & 0 & \cdots & D_{nn} \end{bmatrix} \begin{bmatrix} V_{11} & V_{12} & \cdots & V_{1n} \\ V_{21} & V_{22} & \cdots & V_{2n} \\ \vdots & \vdots & \cdots & \vdots \\ V_{m1} & V_{m2} & \cdots & V_{mn} \end{bmatrix}$$

Where

- U = an orthogonal matrix
- D = a diagonal matrix with non-negative real numbers and all its entries are singular values of A.
- V^T = transpose of an orthogonal matrix V (real or complex unitary matrix, if V is real).

In contrast, the columns of V in the singular value decomposition, called the right singular vectors of A, always form an orthogonal set with no assumptions on A. The columns of U are called the left singular vectors and they form an orthogonal set. A simple consequence of the orthogonality is that for a square and invertible matrix A, the inverse of A is $V D^{-1} U^T$, as the reader can verify.

3.2 Multiple Linear Regression

Multiple linear regression is a statistical technique that predicts values of one variable on the basis of two or more other variables. It is also generic term for any statistical technique used to analyze data from more than one variable.
Regression models involve the following variables:

- The unknown parameters, denoted as β, which may represent a scalar or a vector.
- The independent variables X.
- The dependent variable, Y.

In various fields of application, different terminologies are used in place of dependent and independent variables.

In non-matrix form, the multiple regression model is
$Y_i = \beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + \beta_3 X_{i3} + \cdots + \beta_{n-1} X_{i,n-1} + \varepsilon_i$, $i=1,2,\cdots,n$
where

$$E(\varepsilon_i) = 0;\ Var(\varepsilon_i) = \sigma^2;$$
$$Cov(\varepsilon_i;\varepsilon_j) = 0;\ i \neq j.$$

In matrix terms this can be written as

$$\begin{pmatrix} Y_1 \\ Y_2 \\ \vdots \\ Y_n \end{pmatrix} = \begin{pmatrix} 1 & X_{11} & X_{12} & \cdots & X_{1,n-1} \\ 1 & X_{21} & X_{22} & \cdots & X_{2,n-1} \\ \vdots & \vdots & & \vdots & \\ 1 & X_{n1} & X_{n2} & \cdots & X_{n,n-1} \end{pmatrix} \begin{pmatrix} \beta_0 \\ \beta_1 \\ \beta_2 \\ \vdots \\ \beta_{n-1} \end{pmatrix} + \begin{pmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \vdots \\ \varepsilon_n \end{pmatrix}$$

Multiplying and adding the right-hand side gives

$$\begin{pmatrix} Y_1 \\ Y_2 \\ \vdots \\ Y_n \end{pmatrix} = \begin{pmatrix} \beta_0 & \beta_1 X_{11} & \beta_2 X_{12} & \cdots & \beta_{n-1} X_{1n} + \varepsilon_1 \\ \beta_0 & \beta_1 X_{21} & \beta_2 X_{22} & \cdots & \beta_{n-1} X_{2n} + \varepsilon_2 \\ \vdots & \vdots & & \vdots & \\ \beta_0 & \beta_1 X_{n1} & \beta_2 X_{n2} & \cdots & \beta_{n-1} X_{nn} + \varepsilon_n \end{pmatrix}$$

Y_i denotes response of observation i and Y, vector of all the responses.

- X is a design matrix of covariate for the associated with Y.
- ε_i is the error associated with measuring Y_i and ε, vector of errors associated with Y.

International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2016): 79.57 | Impact Factor (2017): 7.296

- $\beta$is a n vector of the regression coefficients or parameter estimates. The regression residuals can be written as

$$\varepsilon = y - \overline{y}$$

The regression coefficients β_0 and β_i can be found using the following formulas;

$$\beta_0 = \overline{y} - \beta_1 \overline{x}$$

$$\beta_i = \frac{\left(\sum_{i=1}^{n} x_i y_i\right) - n\overline{x}\overline{y}}{\sum_{i=1}^{n}\left(x_i - \overline{x}\right)^2}$$

- $\overline{x}$ is the mean of the x_i^0 s.
- $\overline{y}$ is the mean of the x_i^0 s.

4. Data Collection and Analysis

The study was conducted at Sunyani municipal Hospital, which is currently the Municipal Hospital, located in the Sunyani. The hospital offers public health services to the people in the entire Sunyani municipality and beyond. It also serves as a referral hospital in the region. The target population was newly born babies.

The relevant data on Low Birth Weight infants admitted to the Sunyani Municipal Hospital (SMH) from January 2016 to December 2016 was extracted from patient hospital records. Antenatal history were also extracted. From these, all with Low Birth Weight babies were identified by registration numbers.

The data was tabulated according to the various maternal factors included in the study and was analyzed using MATLAB and R software.

4.1 Dependent variable

The dependent variable for the study was recorded birth weights of newly born babies. The responses were grouped as low birth weight and normal birth weight. Babies with low birth weight were those weights less than 2.5 kilograms and those with weight of 2.5 kilograms.

4.2 Independent variable

Individual level variables were selected. These mainly consisted of maternal variables that may influence the birth weight of a baby. The selection of these variables, was further informed by the review of related literature to enable comparison of findings. The independent variables included: age of mother, ever attended school, blood pressure level, Haemoglobin concentration, location and weight of the mother.

4.3 Data grouping

Data was collected from the Sunyani Municipal Hospital and grouped for further analysis. The location of the mother was group based on mother's availability and easy to hospital and antenatal care. 1,2,3,4 and 5 were used to represent the grouped locations and defined as follows;

1, 2, 3, 4 : Represents mothers who have difficulty in accessing health and antenatal care because of theirlocation.
5: Represents those from areas who have easy access to hospital and antenatal care because of theirlocation.
The data was grouped according to the mother's level of education and defined as follows ;**N:** Represents mothers who have no education.
P: Represents mothers who have only primary education.
J: Represents mothers who have only junior high school education.
S: Represents mothers who have only secondary school education.
T: Represents mothers who have only tertiary education.
Baby weight Y is taken as the dependent variable and other maternal variables are treated as independent variables $X_1,X_2,X_3,X_4,X_5,X_6,X_7,X_8,X_9,X_{10},X_{11},X_{12},X_{13},X_{14}$, where
Y : Baby weight
X_1 : Mother's Age
X_2 : Mother's Haemoglobin concentration
X_3 : Mother's Blood Pressure
X_4 : Mother's weight
X_5 : Mother's with no educational background
X_6 : Mother's with Primary school educational level
X_7 : Mother's with Junior High school educational level
X_8 : Mother's with Senior High school educational level
X_9 : Mother's with Tertiary school educational level
X_{10} : Mothers located at 1
X_{11} : Mothers located at 2
X_{12} : Mothers located at 3
X_{13} : Mothers located at 4
X_{14} : Mothers located at 5

4.4 Analysis with Singular Value Decomposition

Group one which includes the age from Age: 13-20 is shown in Table 1.

Table 1: Age: 13-20 (Group One)

Baby Weight	No:	Haemo globin	Level of education					Location					BP	Weight
			N	P	J	S	T	1	2	3	4	5		
<2	6	10.8	0	0	5	1	0	1	1	1	2	1	108.3	54.8
2<=W<2.5	9	10.64	1	2	5	1	0	3	0	5	0	1	115.5	53.1
>=2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0

From table 1 ;

$$A = \begin{bmatrix} 6 & 10.8 & 108.3 & 54.8 & 0 & 0 & 5 & 1 & 0 & 1 & 1 & 1 & 2 & 1 \\ 9 & 10.64 & 115.5 & 53.1 & 1 & 2 & 5 & 1 & 0 & 3 & 0 & 5 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

Group two which includes the age from Age: 21-28 is shown in Table 2.

Table 2: Age: 21-28 (Group Two)

Baby Weight	No:	Haemo globin	Level of education					Location					BP	Weight
			N	P	J	S	T	1	2	3	4	5		
<2	7	10.1	2	0	1	1	3	1	0	5	1	0	130	64.7
2<=W<2.5	25	9.4	6	2	6	7	4	3	1	14	2	1	120.2	47.3
>=2.5	7	11.9	2	0	2	3	0	1	1	3	0	2	149.7	66.2

From table 2 ;

$$B = \begin{bmatrix} 7 & 10.1 & 130 & 64.7 & 2 & 0 & 1 & 1 & 3 & 1 & 0 & 5 & 1 & 0 \\ 25 & 9.4 & 120.2 & 47.3 & 6 & 2 & 6 & 7 & 4 & 3 & 1 & 14 & 2 & 1 \\ 7 & 11.9 & 149.7 & 66.2 & 2 & 0 & 2 & 3 & 0 & 1 & 1 & 3 & 0 & 2 \end{bmatrix}$$

Group three which includes the age from Age: 29-36 is shown in Table 3.

Table 3: Age: 29-36 (Group Three)

Baby Weight	No:	Haemo globin	Level of education					Location					BP	Weight
			N	P	J	S	T	1	2	3	4	5		
<2	14	11.9	0	1	4	1	4	0	2	8	2	2	128.8	70.6
2<=W<2.5	23	12.6	5	1	12	0	2	4	1	9	7	2	118.6	75.3
>=2.5	4	10.6	1	0	3	0	0	0	1	2	1	0	117.5	71

From table 3 ;

$$C = \begin{bmatrix} 14 & 11.9 & 128.8 & 70.6 & 0 & 1 & 4 & 1 & 4 & 0 & 2 & 8 & 2 & 2 \\ 23 & 12.6 & 118.6 & 75.3 & 1 & 5 & 12 & 0 & 2 & 4 & 1 & 9 & 7 & 2 \\ 4 & 10.6 & 117.5 & 71 & 1 & 0 & 3 & 0 & 0 & 0 & 1 & 2 & 1 & 0 \end{bmatrix}$$

Group one which includes the age from Age: 37-44 is shown in Table 4.

Table 4: Age: 37-44 (Group Four)

Baby's weight	No:	Haemo globin	Level of education					Location					BP	Weight
			N	P	J	S	T	1	2	3	4	5		
<2	3	9.67	0	0	1	2	0	2	0	1	0	0	106	68.4
2<=W<2.5	5	12.6	1	1	3	0	0	1	0	2	1	1	136	69.5
>=2.5	3	10.8	0	0	3	0	0	2	0	0	0	1	113.3	80.4

From table 4 ;

$$D = \begin{bmatrix} 3 & 9.67 & 106 & 68.4 & 0 & 0 & 1 & 2 & 0 & 2 & 0 & 1 & 0 & 0 \\ 5 & 12.6 & 136 & 69.5 & 1 & 1 & 3 & 0 & 0 & 1 & 0 & 2 & 1 & 1 \\ 3 & 10.8 & 113.3 & 80.4 & 0 & 0 & 3 & 0 & 2 & 0 & 0 & 0 & 0 & 1 \end{bmatrix}$$

The MATLAB command >>[*U*,*D*,*V*] =svd(A,0) is used to decompose the matrices A,B,C and D above into three matrices.

To get the new coordinate of vectors in a reduced space we apply the iterative steps below to get the new set of coordinate vectors.

$$Y = Y^T U_K D_K^{-1} \quad (1)$$

$$X_j = X_i^T U_K D_K^{-1} \quad (2)$$

We will then use cosine similarity to find the vector determination values and then rank the results in decreasing order.

$$Sim(a,b) = \frac{a \cdot b}{|a||b|} \quad (3)$$

The results from the decomposed matrices *A*, *B*, *C*, *D* is shown in table 5 below;

Table 5: Vector coordinates

	Group One	Group Two	Group Three	Group Four
Y	[−0.0170 0.0195]	[−0.0140 − 0.0217]	[−0.0157 0.0094]	[−0.0161 0.0202]
X_1	[−0.0602 0.3474]	[−0.0834 − 0.7559]	[−0.0965 − 0.7573]	[−0.0266 − 0.0782]
X_2	[−0.0856 − 0.0889]	[−0.0712 − 0.0009]	[−0.0819 − 0.0648]	[−0.8506 − 0.5090]
X_3	[−0.8948 0.2393]	[−0.9056 − 0.0405]	[−0.8507 0.2064]	[−0.5186 0.8456]
X_4	[−0.4309 − 0.5653]	[−0.4047 0.3340]	[−0.5051 − 0.1119]	[−0.0792 − 0.0370]
X_5	[−0.0041 0.1284]	[−0.0215 − 0.1706]	[−0.0139 − 0.1901]	[−0.0026 − 0.0482]
X_6	[−0.0082 0.2569]	[−0.0040 − 0.0794]	[−0.0047 − 0.0354]	[−0.0026 − 0.0482]
X_7	[−0.0400 − 0.0317]	[−0.0193 − 0.1872]	[−0.0444 − 0.3945]	[−0.0171 − 0.0096]
X_8	[−0.0080 − 0.0063]	[−0.0238 − 0.2097]	[−0.0024 0.0099]	[−0.0043 0.0278]
X_9	[0 0]	[−0.0147 − 0.1090]	[−0.0143 − 0.0510]	[0 0]
X_{10}	[−0.0162 0.2506]	[−0.0108 − 0.0853]	[−0.0093 − 0.1814]	[−0.0116 0.0603]

X_{11}	$[-0.0039 - 0.1348]$	$[-0.0045$	$- 0.0225]$	$[-0.0094\ 0.0112]$		$[0$	$0]$
X_{12}	$[-0.0244\ 0.5075]$	$[-0.0468$	$- 0.4212]$	$[-0.0448$	$- 0.2554]$	$[-0.0074$	$- 0.0825]$
X_{13}	$[-0.0078 - 0.2696]$	$[-0.0062$	$- 0.0628]$	$[-0.0234$	$- 0.2609]$	$[-0.0026$	$- 0.0482]$
X_{14}	$[-0.0080 - 0.0063]$	$[-0.0070 ;-0.0053]$		$[-0.0095$	$- 0.0708]$	$[-0.0050$	$- 0.0078]$

The results from the cosine similarity is shown in table 6 below;

Table 6: Cosine similarity results

	Group One	Group Two	Group Three	Group Four
X_1	0.8549	0.8947	-0.4011	-0.5396
X_2	-0.0872	0.5527	0.3541	0.9925
X_3	0.8296	0.5791	0.9549	0.1333
X_4	-0.2011	-0.1167	0.7266	0.2337
X_5	0.7744	0.9015	-0.4498	-0.7473
X_6	0.7744	0.8665	-0.3963	-0.7473
X_7	0.0468	0.8915	-0.4145	0.1607
X_8	0.0499	0.8961	0.7014	0.8681
X_9	0	0.9052	-0.263	0
X_{10}	0.7946	0.9017	-0.4691	0.8857
X_{11}	-0.7345	0.9303	0.945	0
X_{12}	0.7845	0.895	-0.3577	-0.7232
X_{13}	-0.7345	0.8895	-0.435	-0.7473
X_{14}	0.0499	0.8395	-0.395	-0.322

Hence from table 6 above;

- GROUP ONE:
  $X_1 > X_3 > X_{10} > X_{12} > X_5 > X_6 > X_8 > X_{14} > X_7 > X_9 > X_2 > X_4 > X_{11} > X_{13}$
- GROUP TWO:
  $X_{11} > X_9 > X_{10} > X_5 > X_8 > X_{12} > X_1 > X_7 > X_{13} > X_6 > X_{14} > X_3 > X_2 > X_4$
- GROUP THREE:
  $X_3 > X_{11} > X_4 > X_8 > X_2 > X_9 > X_{12} > X_{14} > X_6 > X_1 > X_7 > X_{13} > X_{10} > X_5$
- GROUP FOUR:
  $X_2 > X_{10} > X_8 > X_4 > X_7 > X_3 > X_{11} > X_9 > X_{14} > X_1 > X_{12} > X_5 > X_6 > X_{13}$

Since Y is dependent on
$X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}, X_{11}, X_{12}, X_{13}, X_{14}$.

- GROUP ONE: It shows low birth weight in this category is closely related to the Age of themother.
- GROUP TWO: It shows low birth weight in this category is closely related to mothers who are located in location 2.
- GROUP THREE: It shows low birth weight in this category is closely related to the mother'sblood pressure level.
- GROUP FOUR: It shows low birth weight in this category is closely related to the mother'shaemoglobin concentration level.

4.5 Analysis with Multiple Linear Regression

The results from R is shown in table 7 below;

Table 7: Output from R studio

	Estimate	Std. Error	t value	Pr (>|t|)
(Intercept)	0.249238	0.606699	0.411	0.682157
L	-0.21447	0.045146	-4.751	7.35e-06 ***
BP	0.008636	0.002261	-3.819	0.000241***
H	0.158613	0.053734	2.952	0.003998 **
MW	-0.02287	0.005732	-3.99	0.000132***
MA	0.040553	0.006165	6.578	2.76e-09 ***
ME	0.226975	0.047672	4.761	7.05e-06 ***

Signif. Codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
Residual standard error: 0.3642 on 93 degrees of freedom
Multiple R-squared: 0.4649, Adjusted R-squared: 0.4304 F-statistic: 13.47 on 6 and 93 DF, p-value: 6.163e-11

4.5.1Multiple regression model

$y = \beta_o + \beta_1 L + \beta_2 BP + \beta_3 H + \beta_4 MW + \beta_5 MA + \beta_6 ME + \varepsilon$
β_0=0.249238 ,β_1=-0.214470 , β_2=0.008636 , β_3=0.158613 ,β_4=-0.022870 ,β_5=0.040553 ,β_6=0.226975

Therefore the fitted model will be
$\hat{y} = 0.249238 - 0.214470L + 0.008636BP + 0.158613H - 0.022870MW + 0.040553 + 0.226975ME$

Conclusions

The study results highlight some factors that are significantly associated with Low Birth Weight.

The results from the singular value decomposition analysis of Low Birth Weight with some predictor variables that influence low birth of newly born babies are mother's age, mother's located in location 2, blood pressure level and mother's haemoglobin concentration level.

From the Multiple linear Regression model, it shows that all our maternal variables are significant.

That is the predictor variables mother's age, mother's location, mother's weight, mother's blood pressure, mother's haemoglobin concentration and mother's educational level were all statistically significant.

Now comparing the singular value decomposition analysis and the Multiple linear Regression analysis, we conclude the mother's haemoglobin concentration level is a more significant factor affecting the weight of babies.

Based on the findings from this study, the following recommendations are made to reduce the risk of an infant getting low birth weight.

Some actions taken before birth to avoid low birth weight are; regular checkup, appropriate nutrition intake, check haemoglobin status, taking of iron. The mother's inability to gain weight should be identified, corrected and deleted early to avoid problems. Such actions should be taken before birth.

References

[1] Batech, M. M., Tonstad, S. S., Job, J. S., Chinnock, R. R., Oshiro, B. B., Merritt, T. A., & Singh, P. N. (2013). Estimating the impact of smoking cessation during pregnancy: the San Bernardino County experience. Journal of Community Health, 38(5), 838-846.doi:10.1007/s10900-013-9687-8

[2] D. Almond and J. Currie. Killing me softly: The fetal origins hypothesis. The Journal of Economic Perspectives, 25(3):153-172, 2011.

[3] Fosu, M. O., Munyakazi, L., &Nsowah-Nuamah, N. (2013). Low Birth Weight and Associated Maternal Factors in Ghana. *Journal of Biology, Agriculture and Health*, ISSN 2225-093X.

[4] Ghana Statistical Service, (2012).2010 Population and Housing Census, Brong-Ahafo Regional Analytical Report.

[5] L. Delaney, M. McGovern, and J. P. Smith. From angela's ashes to the celtic tiger: Early life conditions and adult health in ireland. Journal of Health Economics, 30:1-10, 2011.

[6] L. Dearden, L. Sibieta, and K. Sylva. The socio-economic gradient in early child outcomes: evidence from the millennium cohort study. Institute for Fiscal Studies, IFS Working Papers: W11/03, 2011.

[7] Nagarajan D.,Nagarajan V., Sunitha P., Seethalekshmi V., (2010). "Analysis of Birth weight using Singular Value Decomposition", (IJCSIS) International Journal of Computer Science and Information Security, Vol. 7, No.1.

[8] Silvestrina, S. S., Silva, C., Hirakata, V. N., Goldani, A. S., Silveira, P. P., &Goldanie, M. Z. (2013). Maternal education level and low birth weight: a meta-analysis. Journal De Pediatria, 89(4), 339-345.doi:10.1016/j.jped.2013.01.003

[9] Sachin S. Mumbare, RekhaRege (2010) Antenatal care services utilization, delivery practices and factors affecting them in tribal area of north Maharashtra. pp 87-90.

[10] W.H.O: The WHO Child Growth Standards. 2012, http://www.who.int/childgrowth/standards/chts wfa _ girls z/en/index.html,