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Low Birth Weight and Associated Maternal Factors in Ghana

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Abstract

This study examines the prevalence of low birth weight (LBW) among infants and its association with maternal factors in Ghana. The study used a data set based on alongitudinal study from the fourth round Multiple Indicators Cluster Survey (MICS). This was a national survey conducted by Ghana Statistical Service (GSS) in 2011 to monitor the progress of women and children. A sample of 10,963 women within the reproductive age (15 - 49 years) across the country between 2009 and 2011 were selected for the survey.

In this study, a multiple logistic regression was used to determine the relationship of maternal factors and low birth weight. The estimated LBW prevalence was 9.2% which is higher than other part of the world. Few children are weighed at birth as less than 50% of babies born in Ghana are weighed at birth.This means that the prevalence rate could be higher than the current estimate. This stands to reason that the rate still indicates a public health problem (ACC/SCN, 2000). The factors observed to be highly significantly associated with LBW included Antenatal Care (p-value =0.0010), Educational level (p-value =0.0011), Location (p-value =0.0011) and Economic status (p-value=<0.0001) as well as Central region (p-value= 0.0003). There is also risk for maternal age less than 24 and above 35 years (p-value=1.3409E-19 and 3.8257E-21 respectively), mothers who had given birth to more than four children (p-value=1.4519E-33) and women in Northen region (p-value= 0.0535). All other variables considered such as malaria in pregnancy, ethnicity, and marital status were not very significant (p-values > 0.05).

In a nutshell, economic status, educational level, antenatal care and location are highly significantly risk factors associated with LBW in Ghana. Early/late maternal age and parity of more than four also showed some level of significance with LBW. Malaria in pregnancy, ethnicity, and marital status among others were however not significant.

Keywords: Low birth weight, maternal factors, prevalence rate, risk factors.

1. Introduction

Childbirth all over the world comes with joy not only for the new-borns' parents but the family at large. It attracts attention from both close relations and community members. Typically in Ghana, the family members, especially the women clad themselves in white clothing from headgear to footwear. However, the course of pregnancy is not given such needed attention. The onus lies solely with the woman who is pregnant despite the fact that scientific literature has indicated that the outcome of pregnancy depends on both external and internal factors experienced by the pregnant woman (Abel 1980, Browne et al 2001).

Birth weight is an important indicator of reproductive health and general health status of population. Low birth weight (LBW) continues to remain a major public health problem worldwide especially in the developing countries. It is considered the single most important predictor of infant mortality, especially deaths within the first month of life (Abel 1980, Abrams et al 2000).

Low birth weight infants are those who weigh less than 2.5 kg at birth and it usually happen with pre-term birth. A pre-term birth is defined as birth before 37 weeks of gestation. Half of all perinatal and one third of all infant deaths are directly or indirectly related to LBW (Aurora S. et al 1994). A child's birth weight or size at birth is an important indicator of the child's vulnerability to the risk of childhood illnesses and the chances of survival. Children whose birth weight is less than 2.5 kilograms, or children reported to be "very small" or "smaller than average" are considered to be small or of low birth weight and have a higher risk of early childhood death. Those who survive have impaired immune function and increased risk of disease are likely to remain undernourished,

with reduced muscle strenght throughout their lives, and may suffer a higher incidence of diabetes and heart disease later in life (Bale et al 2003, Behrman et al 2006). Children born underweight also tend to have a lower IQ and cognitive disabilities, affecting their performance in school and their job opportunities as adults (Boerma et al 1996, GSS MICS 2006).

Pre-term delivery of low birth weight infants (PLBW) is on the increase and gradually becoming an important problem in both developing and developed countries. In spite of consistent efforts to improve the quality of maternal and child health, more than 20 million infants in the world (15.5% of all births) are born with low birth weight (Aurora et al 1994). Ninety-five per cent of them are in developing countries with the rate of low birth weight in developing countries being more than double that of developed countries (16.5% and 7% respectively). In Sub- Saharan Africa, the rate is around 15% (UNICEF and WHO 2004).

In Ghana, the issue of birth weight and factors influencing it has not received much needed attention. This should be an issue of public health concern as a nation because birth weight is a strong predictor of an individual baby's survival and a person's personality (Datta 1978, Dhar GM et al 1991). The recommended weight at birth should be in the range of 2.5kg to 4.0kg (Garner et al 1992). From 1998 to 2004, Ghana recorded higher LBW cases of 16% compared to the average of 14% for sub-Saharan Africa (Gupta et al 1992). The 2006 MICS report, however, found the prevalence rate to be 9.1%. The difficulty is that only 2 in 5 babies were weighed at birth (MICS 2006). Though the major and primary determinant of birth weight is gestational age (Humphreys 1954, Deshmukh et al 1996), there are other secondary factors that also bear, either directly or indirectly, on determining the weight of a baby at birth. These are maternal age, maternal weight gain, pre-pregnancy weight, maternal height, parity, marital status, placental malfunction, smoking, heredity, gender of baby, working hours, and various socio-economic factors (Hirve et al 1994, Kelly et al 1996, Kumar et al 1987, Kramer 1987). In developing countries, the major determinants of LBW babies are racial origin, nutrition, low pre-pregnancy weight, short maternal stature, and malaria (Nurulet al 1993). A World Health Organization Collaborative Study of Maternal Anthropometry and Pregnancy Outcomes reported that weight gained at 5 or 7 lunar months was the most practical screening for LBW and Intrauterine Growth Retardation (IUGR) (Obed et al 2006). The reduction of the incidence of low birth weight also forms an important component of the Millennium Development Goals (MDGs) on child health. Activities towards the achievement of the MDGs will need to ensure a healthy start in life by making certain that women commence pregnancy healthy and well nourished, and go through pregnancy and childbirth safely (GSSet al 2004). Low birth weight is, therefore, an important indicator for monitoring progress towards these internationally agreed-upon goals. Earlier works stated the birth weight of infants in Ghana ranged from 2.00 kg to 3.00 kg (Peoplesshepset al 1991, SPSS2004). With this background and fortified by the fact that limited number of such facility based prospective studies are available, we undertake the present study to define the extent of LBW problem in Ghana and investigate the martenal factors associated with this condition.

2. Data

The 2011 Multiple Indicator Cluster Survey (MICS) data was used in this study. This is a fourth round of the survey which is conducted every five years to monitor the situation of children and women in Ghana. In this survey about 10,963 women who were within the reproductive age (15 – 49 years) were selected across the ten Regions of Ghana. The subjects were interviewed reference to two years preceding the survey. The selection procedure was based on a representative probability sample of households nationwide from a frame of Ghana Living Standards Survey 5 Enumeration Areas (EA's). For comparability, the MICS used an internationally standardized sampling of two-stage stratified sample design. At the first stage, a number of EA's were selected from the regions which were considered as clusters. The households in each region were then selected using systematic sampling with probability proportional to their size in the second stage.

3. Methodology

In our study, we excluded all stillbirths and multiple births that occurred during these years. Only singleton births and live births were included. Relevant information related to maternal factors, namely; age, socio-economic factors, antenatal services, location/area (urban, rural), region, wealth quintiles, placental malfunction, malaria in pregnancy, mothers' education, marital status among others were studied. The information were then captured and analysed using SAS 9.2 software (SAS, 2009). Unfortunately, gestation period of pregnancy which could be used to determine pre-term and term births was not captured by the survey instrument. The World

Health Organization definition of LBW was used. i.e., birth weight less than 2.5 kg to delineate between normal birth weight and LBW.

3.1 Model Specification

The following generalized linear logistic model was used

$$\pi = \log\left(\frac{u}{1-u}\right) = X\beta + \varepsilon \quad (1)$$

Where π links the linear function to $log\left(\frac{u}{1-u}\right)$. The link is not a linear function, μ *is* the probability of LBW, X is the model matrix including mother's age, educational level, antenatal care, location of mother, malaria in pregnancy, and sex of baby**.** The matrix also includes geographical location, such as region of origin and whether the respondent is from rural or urban environment; β is the vector of parameters, and ε is the vector of residuals. The Fisher scoring method was applied (SAS, 2007) to obtain Maximum Likelihood estimates of β. The overall goodness of fit is derived from the Likelihood Ratio Test of the hypothesis $H_0: c(\beta)$=0 where a comparison is made between the full model and the model that contains only the intercept (Hilbe and Greene, 2008). Therefore it is a test for global null hypothesis of the elements of the solution vector.

4. Empirical Results

The LBW prevalence in this study was 9.2% (from our sample of non-missing weights). Table 1 provides a descriptive view of the different categories. Five regions; Western, Volta, Greater Accra, Brong Ahafo and Eastern all recorded rates lower than the national figure of 9.2%. Women from Central region are more likely to give birth to low birth weight children (23.3%) and those from Western region the least likely to give birth to low birth weight children (2.9%). Women from rural households, those from the poorest households and those who have a maximum of middle school education are more likely than more advantaged women to give birth to children of low birth weight. For example, the proportion of low birth weight among women who have a maximum of middle school education is 86.4%, compared to 13.6% of women who have a minimum of secondary school education. Women in rural households are likely to give birth to children of low birth weight compared to those in urban households. Women from wealthiest households are more likely to give birth to normal weight children compared to children from poorest households. The possibility of giving birth to children of low birth weight among women who have at least two children is higher than those who have only one child (35% versus 28.1%). Again, women who are at most 24 years or above 35 years have highest proportion of children weighing less than 2.5 kg. Table 2 depicts the results of multivariate logistic analysis of maternal factors associated with LBW. The factors observed to be highly significantly associated with LBW included antenatal care (p-value=0.0010), educational level of

the mother (p-value=0.0011). location (p-value=0.0011), and economic status (p-value=<.0001) as well as women who give birth in Central region (p-value=0.0003). There is also some risk for maternal age less than 24 and above 35 years (p-value=1.3409E-19 and 3.8257E-21 respectively) and the Northen region (p-value=0.0535).

Table 1. Descriptive statistics of the Study Population

Indicator	Mean bwt. (bwt <2.5 kg.)	Percentage (N)	Std. error
Maternal age (yrs.)			
<24	2.13325	23.3 (24)	0.073679
25 – 29	2.10534	28.1 (29)	0.063166
30 – 34	2.15195	21.5 (22)	0.034460
35+	2.05082	27.2 (28)	0.075487
Antenatal care			
Attended at least once		96.4 (2771)	
Not attended	2.10698	3.6 (102)	0.032712
Baby's weight			
LBW (< 2.5 kg)	2.10690	9.2 (111)	0.032712
Normal (≥ 2.5 kg)		90.8 (1095)	
Children ever born			
0	2.14495	36.9 (38)	0.048552
1	2.03393	28.1 (29)	0.080368
≥2	2.12575	35.0 (36)	0.044194
Wealth index quintiles			
Poorest	2.12950	21.4 (22)	0.078005
Second	2.03970	19.4 (20)	0.067350
Middle	2.03692	24.3 (25)	0.081470
Fourth	2.25196	22.3 (23)	0.031015
Richest	2.05062	12.6 (13)	0.097705
Mother's education			
Pre school	2.18182	21.3 (22)	0.059811
Primary	2.00452	24.3 (25)	0.092586
Middle	2.13638	40.8 (42)	0.038127
Secondary+	2.08414	13.6 (14)	0.091201
Area/Location			
Urban	2.07592	49.5 (51)	0.057624
Rural	2.13744	50.5 (52)	0.031775
Region			
Western	1.66667	2.9 (3)	0.33333
Central	2.05075	23.3 (24)	0.05901
Greater Accra	2.00000	4.9 (5)	0.25884
Volta	2.18750	3.9 (4)	0.06575
Eastern	2.26875	7.8 (8)	0.06046
Ashanti	2.23300	9.7 (10)	0.05077
Brong Ahafo	2.18750	7.8 (8)	0.06928
Northern	2.26154	12.6 (13)	0.05493
Upper East	1.96000	14.5 (15)	0.12166
Upper West	2.09777	12.6 (13)	0.08700

Table 2. Maternal Factors Associated with LBW –Logistic Fixed Effets Regression Model

Standard Wald 95% Confidence				Wald			
Parameter	**DF**	**Estimate**	**Error**	**Limits**		**Chi-Square**	**Pr > ChiSq**
Intercept	1	-0.1986	1.1167	-2.3874	1.9901	0.03	0.8588
Age of woman	1	-0.0710	0.0632	-0.1948	0.0528	1.26	0.2608
Age of woman Square	1	0.0009	0.0011	-0.0011	0.0030	0.80	0.3704
Chn. Ever Born	1	0.0556	0.0472	-0.0369	0.1481	1.39	0.2388
REGION							
Western	1	0.4065	0.2821	-0.1463	0.9594	2.08	0.1495
Central	1	0.8762	0.2440	0.3979	1.3545	12.89	0.0003
Greater Accra	1	-0.3996	0.3455	-1.0768	0.2775	1.34	0.2474
Volta	1	0.0374	0.2897	-0.5303	0.6053	0.02	0.8973
Eastern	1	0.2584	0.2925	-0.3149	0.8317	0.78	0.3770
Ashanti	1	0.3743	0.2803	-0.1750	0.9236	1.78	0.1817
Brong Ahafo	1	0.1508	0.3073	-0.4515	0.7531	0.24	0.6236
Northern	1	0.5145	0.2664	-0.0078	1.0367	3.73	0.0535
Upper East	1	-0.0310	0.2801	-0.5799	0.5180	0.01	0.9120
Upper West	0	0.0000	0.0000	0.0000	0.0000	-	-
Antenatal care	1	1.8613	0.5667	0.7506	2.9721	10.79	0.0010
Educational levels	1	-0.2520	0.0775	-0.4038	-0.1002	10.58	0.0011
Wealth Quintiles	1	-0.3919	0.0646	-0.5186	-0.2653	36.79	<0.0001
Location/Residence	1	0.4881	0.1496	0.1948	0.7813	10.64	0.0011
Scale	0	1.0000	0.0000	1.0000	1.0000	-	-

Confounder control by multiple logistic regression analysis revealed that significance factors (in descending order of odds ratio) were economic status, antenatal care, educational level, location, parity and maternal age (table 2). The highly significant variables were however economic status, antenatal care, educational level and location.

5. Discussion

The 9.2% prevalence of low birth weight (mean = 2.105 ± 0.031) and the normal mean birth weight of 4.012 ± 0.062kg observed in this study is comparable to other studies in the developing world. The missing link is that few mothers in Ghana give birth at health facilities and hence their babies are not weighed at birth. The descriptive statistics show that mothers in rural areas tend to give birth to low birth weight children than women who live in urban areas. Again, women who have higher education give birth to normal birth weight babies than women who are not educated or have low levels of education. Women whose economic status is high also produce normal birth weight babies than those who live below the poverty line. Women who receive antenatal care services even once tend to give birth to normal weight babies than those who receive no antenatal services.

(38.1% and 25.0%) respectively. The association of economic status, antenatal care, location, educational levels, maternal age and children ever born with low birth weight observed in this study has also been reported from other developed and developing countries apart from gestational age which was not captured by the survey instrument. Again, the prevalence of LBW though lower than the 15% threshold, should still be a source of worry to the nation as it indicates less than 50% of babies born within the survey period since majority of children born during the period of study were not weighed at birth.

The risk of delivering LBW was higher in women who had no or low education, poor economic status, live in rural areas, received no antenatal care, under 20 years and above 35 years, live in Central region and had at least four children.

6. Conclusion

The results of this study suggest that for reducing LBW, the strategy needs to focus attention on nutrition education to facilitate better weight gain during pregnancy focusing more on the girl-child education, regular antenatal care visits and discouraging teenage and old age pregnancy as well as formulating policies that will reduce poverty among rural women. The girl child education policy must also be given all the needed resources it requires to achieve the desired set targets.

The low variability in birth weight that was explained by independent variables used in all the regression models suggests that there were some confounding factors not accounted for. Within the limits of this research however, educational levels, antenatal care, economic status and location contributed significantly in predicting birth weight in Ghana.

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