RISK FACTORS FOR LOW BIRTH WEIGHT: BIVARIATE ANALYSIS OF FINDINGS FROM THE ZIMBABWE 2014 MULTIPLE INDICATOR CLUSTER SURVEY

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ABSTRACT:

Background: Birth weight has significant association with future survival chance and wellbeing of a newborn. If a newborns weight is less than 2,500g, it is considered as low birth weight. Low birth weight is ranked as the tenth-leading cause of death in Zimbabwe. This study aimed to identify factors that are associated with low birth weight in Zimbabwe.

Methods: A cross-sectional cluster survey was done by using secondary data from the Zimbabwe Multiple Indicator Cluster Survey 2014. From 3,910 children who were born during the two years prior to the survey, only 3,221 were weighed at birth. Independent variables were categorized into household socio-demographic, maternal and fetal factors. Bivariate logistic regression analyses were used to assess associations between the independent variables and low birth weight. Odds ratio was accompanied by 95% confidence intervals and p-values for each independent variable that was tested for association with low birth weight. The bivariate analyses were used in order to take account of the clustering nature of the survey design and the women's sample weights from the survey.

Results: Out of the 3,221 children who were weighed at the time of their birth, 271, 8.4% had low birth weight. Having at least one mosquito net in a household was the only household socio-demographic factor that was associated with lower risk of low birth weight (OR: 0.778, 95% CI: 0.588, 1.028, P = 0.078). Being a mother at the age of 20 to 34 years (OR: 0.681, 95% CI: 0.482, 0.961, P = 0.029), iron tablet supplementations during pregnancy (OR: 0.693, 95% CI: 0.489, 0.982, P = 0.039) and taking the iron supplementation to a longer duration (OR: 0.893, 95% CI: 0.819, 0.973, P = 0.039) were associated with lower odds of giving birth to a low birth weight baby. Being a second or a third born baby in birth order (OR: 0.646, 95% CI: 0.467, 0.894, P = 0.008) and having two years (OR: 0.533, 95% CI: 0.343, 0.829, P = 0.005) or 3 years (OR: 0.529, 95% CI: 0.336, 0.834, P = 0.006) of birth interval with the previous sibling were fetal factors that are associated with lower risk of low birth weight. Twin or multiple pregnancy was strongly positively associated with low birth weight (OR: 14.277, 95% CI: 8.243, 24.729, P <0.001).

Conclusion: Some of the modifiable factors, such as visiting antenatal care more frequently and taking iron tablet supplementation and taking it for longer durations, appear to help reduce the risk of low birth weight in Zimbabwe.

Keywords: Low birth weight, Multiple Indicator Cluster Survey 2014, Risk factors, Zimbabwe

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INTRODUCTION

Birth weight has significant association with future survival chance and wellbeing of a newborn [1]. Low birth weight is considered as the single most important predictor of infant mortality, especially of deaths within the first month of life [2]. More than fifty percent of the neonatal deaths occur among

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those who are weighed below 2500 kilograms. Low birth weight has also been linked with childhood developmental delays as well as metabolic, infectious, and chronic illnesses in future life [3].

Birth weight is the weight of a newly born baby that is measured right after birth. For babies that are born alive, it should be taken within the first hour, if possible. This is because substantial weight loss can happen if the measuring time is delayed. Low birth weight has been defined by the World Health Organization (WHO) as weight at birth of less than 2,500 grams (5.5 pounds) [4]. Globally 16 percent, more than 20 million of all the live birth newborns are low birth weight. Since, home delivery accounts for large proportion of babies born in low income countries this incidence of LBW is considered to be underestimated. The incidence in the low-income countries is more than double of the incidence in the middle income countries [2]. In developing countries approximately one out of ten infants dies from a complications related to low birth weight [5].

Many studies showed that the birth weight of a new born is associated with socio-economic, fetal, maternal and environmental factors. A case-control study of Socioeconomic factors and low birth weight, in Mexico City concluded that low socioeconomic level was the most important risk factor for LBW [6] . Another study in Sudan found low educational level of mother was a risk factor for LBW [7]. Another study also found an association between living in a deprived neighborhood and Low birth weight (preterm birth and small-for-gestational age) [8].

In a study conducted in North Tanzania low birth weight is associated with adverse perinatal outcomes. Multivariate logistic regression showed that pre-eclampsia, eclampsia , chronic hypertension, maternal anemia , smoking during pregnancy , caesarean section delivery, placental abruption, placenta previa, Premature Rupture of Membranes (PROM), maternal underweight, and obesity and female gender of baby were significantly associated with delivery of low birth weight infants [9]. In rural Gambia low birth weight was associated with antepartum hemorrhage and hypertensive pregnancy disorders. In addition to these, primi parity was associated with low birth weight [10].

The harmful impact of cigarette smoking on birth weight was identified as early as 1979 [11]. The weight of full-term babies born to smoking mothers are less than the average newborn and babies born to heavy smokers are more affected [12-14]. Environmental tobacco Smoke, passive smoking of pregnant mothers reduces mean birth weight [15]. A similar study also concluded nonsmokers exposed women have increased risks of giving birth to infants with lower birth weight [16].

The World Bank estimated the Low birth weight in Zimbabwe as 11% of all the live births between the years 2007 and 2013 [17]. Out of all the live births preceding 2 years the survey 10.1 percent were categorized as low birth weight. In Zimbabwe low birth weight is placed tenth in the rank of causes of mortality. In the WHO data reported in 2014 Low Birth Weight deaths in Zimbabwe reached 6,401 or 5.03% of total deaths. The age adjusted Death Rate is 28.19 per 100,000 of population ranks Zimbabwe number 15 in the world [18]. Considering the low birth weight (11%) from World Bank there is a need to identify factors associated with low birth weight in Zimbabwe.

The objective of this study was to determine the socio-demographic, maternal and fetal factors that affect the birth of a baby based on the data that was collected in the 2014 Multiple Indicator Cluster of Zimbabwe.

METHODS

Study design

The study design of this research was the analysis of a secondary data of Zimbabwe MICS 2014. The primary data was collected through a nationwide cross-sectional study design. The households that were included in this study were selected through cluster sampling. From 3,910 children who were born during the two years prior to the survey, only 3,221 were weighed at the time of their birth. These weighed children and their mothers were included in this study.

Data management

The data sets for the secondary study were obtained by requesting the official website of United Nations International Children's Emergency Fund (UNICEF) that deals with global MICS. Eight SPSS data sets were obtained and three were used for this study. The data management work started by merging the different data files. A unique ID for variable for merging the data sets was created from the available variables in the data sets. The three data files that contain the variables of interest for this study were, the household data file, the women in reproductive age (15-49 years of age) data file and the birth history data file. The household data file

Table 1 The relationship of the household characteristics of the mothers of the last live born children in the preceding two years of the ZMICS2014 with Low birth weight, a bivariate analysis

Variables	OR	t	95%CI		*P-value*
Residence					
Urban (ref.)	1				
Rural	1.129	0.85	0.854	1.493	0.395
Educational level of HHH					0.759*****
No education (ref.)	1				
Primary	0.939	-0.18	0.473	1.864	0.857
Secondary	0.883	-0.36	0.447	1.746	0.72
Higher	1.164	0.39	0.537	2.522	0.700
Wealth index quintile					0.550*****
Poorest(ref.)	1				
Second	0.794	-1.08	0.521	1.209	0.282
Middle	1.041	0.19	0.693	1.563	0.847
Fourth	0.788	-1.2	0.534	1.164	0.231
Richest	0.909	-0.47	0.613	1.348	0.635
Mother tongue of head of HH					0.609*****
Shona(ref.)	1				
Ndebele	1.165	0.89	0.831	1.633	0.376
Other language	1.148	0.62	0.740	1.781	0.536
Type of household fuel					
Non-biomass fuel	1				
Biomass fuel	1.173	1.08	0.877	1.569	0.281
Having mosquito net at least 1					
No(ref.)	1				
Yes	0.778	-1.77	0.588	1.028	0.078
Province					0.243*****
Religion of HHH ¥					0.889*****

**p-value* for the variable as a whole ¥ HHH = Head of household

comes from the household questionnaire and the latter two data files, the women's file and the birth history file, both come from the women's questionnaire of the MICS.

Data analysis

Independent variables were categorized into household socio-demographic, maternal and fetal domains. Bivariate data analysis was done by logistic regression to identify the relationship between dependent and independent variables, assessing one independent variable at a time. Odds ratios were accompanied by *p-values* and 95% confidence interval (CI). *P-values* less than 0.05 were considered as statistically significant level for results of analysis. All the descriptive part was done in Statistical Package for the Social Sciences (SPSS) version 22 and the inferential statistics, and the bivariate analysis reported here, were done in Stata version 12. Stata was used to take account of the clustering nature of the survey design and the women's sample weights from the survey.

RESULTS

Birth weight

Out of the 3,910 babies 3,221(82.4%) were weighed at the time of birth. 2,950(91.6%) of the weighed babies were weighed 2,500g or more at the time of birth and 271(8.4%) were weighed below 2,500g. 689(17.6%) of the babies were not weighed at the time of birth. These babies were excluded from the analyses reported here.

Household socio-demographic characteristics

Table 1 shows the bivariate analysis of the relationship of the household socio-demographic characteristics of the mothers of the last live born children in the preceding two years of the ZMICS2014 with Low birth weight. Household characteristics, province, residence area (urban or rural), educational level of head of the households, wealth index quintile, religious faith of the head of the household, mother tongue of the head of the head of the household and availability of at least one mosquito net in the household were considered.

Bivariate logistic regression was done to see if there is significant difference in odds ratio of giving a low birth weight baby between the mothers from different subgroups of the household characteristics. Out of all the household characteristics only availability of at least one mosquito net in a household seems slightly associated with a lower risk of giving birth of a low birth weight baby. Mothers from households that had at least one mosquito net have 0.84 times odds ratio of giving birth to a low birth weight baby when compared to mothers from households that don't, (OR: 0.778, 95% CI: 0.588, 1.028, P = 0.078).The mosquito net ownership characteristic is the only household factor that was carried on to the multivariable logistic regression.

Maternal characteristics

Table 2 shows a bivariate analysis of the relationship of the maternal characteristics of the last live born children in the preceding two years of the ZMICS2014 with Low birth weight. According to their age at the time of giving birth to the children the mothers were categorized in to three groups, mothers who were below the age of 30 years, 20 to 34 years and 35 years and above. In the bivariate logistic regression, the latter two age groups of mothers were compared to the teen aged mothers. The second group of mothers has a reduced risk of giving birth to a low birth weight baby, the odds ratio of giving low birth weight baby in this age group was 0.68 times the odds ratio in the comparison group, (OR: 0.68, 95% CI: 0.48, 0.96). This was statistically significant at a p-value of 0.029. While the oldest age group of mothers didn't show any significant difference in the chance of giving birth of low birth weight babies.

Educational level of the mothers was also a factor that was considered to contribute in the risk of giving birth to a low birth weight babies. Mothers were categorized in to four educational levels, mothers with no education, mothers who reached to primary, secondary or higher levels. In the bivariate logistic regression the three groups of mothers with education were compared separately to the mothers with no education. There were no significant differences in the odds ratio of giving birth to low birth weight babies, Table 2.

Data on whether the pregnancy that led to the last live born child was wanted also was considered in the analyses. On the bivariate analysis in comparing the chances of giving birth to low birth weight baby between the mothers who wanted the pregnancy and mothers who didn't showed no significant difference, Table 2.

Mothers who attended to any antenatal care services were compared to mothers who didn't receive any antenatal care during their last pregnancy time. No significant difference on the odds ratio of giving birth to a low birth weight baby was observed between these two groups of mothers. However when the number of antennal visits was considered, mothers with higher number of visits tend to have a lower risk of giving low birth weight babies, (OR: 0.96, 95% CI: 0.91, 1.01), with a *p-value* of 0.133. Starting antenatal visits by the age of pregnancy(in months) was also analyzed; mothers who start the antenatal visits in a later gestational age were with at a relatively lower risk of giving a low birth weight baby, (OR: 0.95, 95% CI: 0.88, 1.02), with a *p-value* of 0.143, table 2. Mothers got the ANC cervices from different health professionals, doctors, nurses/midwives or traditional birth attendants. There was no significant difference on the odds of giving birth to a low birth weight baby when who provided the antenatal care was compared to those who did not get the services, Table 2.

In the bivariate analysis, Iron tablets intake during pregnancy was significantly associated with a lower risk of giving birth to a low birth weight baby. Mothers who took iron during their gestation time have lower risk of giving birth to a low birth weight baby, the odds ratio of giving birth to a low birth weight baby in mothers who took iron tablet during their pregnancy period is 0.69 times when compared to mothers who didn't take any iron tablet supplementation, (OR: 0.69, 95% CI: 0.49, 0.98) with a p-value of 0.039. Duration of iron tablet intake during the pregnancy was also inversely associated with a risk of low birth weight. As the duration of iron intake increased the risk of giving birth to a low birth weight baby decreased, (OR: 0.89, 95% CI: 0.82, 0.97), with a *p-value* of 0.010. However, folate tablet intake and duration of folate tablet intake were not associated with chance of giving birth to low birth weight babies, Table 2.

Other maternal factors such as, taking malaria prophylaxis, number of times malaria prophylaxis taken, mothers' ever smoked cigarette, mothers' ever drunken alcohol and number of usual alcohol drinks were taken in to account in the bivariate analysis. However, none of these factors was significantly associated with the mothers' odds ratios of giving birth to a low birth weight baby, Table 2.

Table 2 The relationship of the maternal characteristics of the mothers of the last live born children in the preceding two years of the ZMICS2014 with Low birth weight, a bivariate analysis

Variables	OR	t	95% CI		*P-value*
Mother's age at the time of birth					0.034*
<20(ref.)	1				
20-34	0.681	-2.19	0.482	0.961	0.029
35+	1.011	0.05	0.623	1.642	0.964
Educational level of the mother					
No education (ref.)	1				
Primary	1.254	0.28	0.256	6.139	0.779
Secondary	1.396	0.42	0.29	6.717	0.677
Higher	0.964	-0.04	0.182	5.089	0.965
Pregnancy wanted					
No(ref.)	1				
Yes	1.013	0.08	0.747	1.373	0.933
ANC received					
No(ref.)	1				
Yes	0.704	-0.72	0.27	1.836	0.473
Number of ANC visits					
-	0.96	-1.5	0.911	1.013	0.133
Start of ANC visit					
-	0.945	-1.47	0.876	1.019	0.143
ANC provider					
No ANC visits(ref.)	1				
Doctor	0.889	-0.54	0.58	1.363	0.589
Nurse/Midwife	0.738	-1.11	0.433	1.26	0.265
CHW/TBA$ or others	1.105	0.09	0.116	10.558	0.931
iron intake during pregnancy					
No(ref.)	1				
Yes	0.693	-2.07	0.489	0.982	0.039
Duration iron tablets taken					
-	0.893	-2.58	0.819	0.973	0.010
Folate intake during pregnancy					
No(ref.)	1				
Yes	0.946	-0.38	0.706	1.267	0.707
Duration folate tablets taken malaria prophylaxis taken	0.958	-1.14	0.889	1.032	0.255
No (ref.)					
Yes	0.983	-0.12	0.745	1.298	0.905
Number of times malaria prophylaxis					
-	0.983	-0.24	0.848	1.138	0.814
Mother ever smoked					
No (ref.)	1				
Yes	0.924	-0.12	0.266	3.207	0.901
Mother ever drunk					
No (ref.)	1				
Yes	0.969	-0.16	0.655	1.435	0.876
Number of drinks usually consumed					
-	0.981	-0.06	0.534	1.802	0.951

***** *p-value for the variable as a whole*

$ CHW=Community Health Worker, TBA=Traditional Birth Attendant

Fetal characteristics

Table 3 shows the bivariate analysis of the relationship of the fetal characteristics of the last live born children in the preceding two years of the ZMICS2014 with Low birth weight. Baby gender with was slightly associated with low birth weight. When male babies are compared with female babies they tend to have a lowered risk of becoming low birth weight. The odds ratio of becoming low birth weight baby in males is 0.83 times when compared

Table 3 The relationship of the fetal characteristics of the last live born children in the preceding two years of the ZMICS2014 with Low birth weight, a bivariate analysis

	OR	t	95%CI		*P-value*
Baby gender					
Female	1				
male	0.828	-1.35	0.629	1.089	0.176
Birth order					0.066*
1(ref.)	1				
2--3	0.646	-2.64	0.467	0.894	0.008
4--6	0.821	-1.03	0.564	1.194	0.301
7+	0.646	-0.9	0.249	1.678	0.369
Interval in years					0.007*
< 2(ref.)	1				
2	0.533	-2.8	0.343	0.829	0.005
3	0.529	-2.75	0.336	0.834	0.006
4+	0.813	-1.26	0.59	1.122	0.207
Twin					
single	1				
Twin(Multiple birth)	14.277	9.5	8.243	24.729	<0.001

** p-value for the variable as a whole*

to females, (OR: 0.83, 95% CI: 0.63, 1.09), with a *p-value* of 0.176.

In the bivariate analysis of birth order and low birth weight, first born babies were considered as a reference group to the group of 2nd or 3rd born babies, 4th-6th born babies, and 7th or above born babies. The 2nd or 3rd born babies have lowered risk of becoming a low birth weight baby, (OR: 0.65, 95% CI: 0.47, 0.89) when compared to the first born babies, with a p-value of 0.008. The other two groups seem to have a lower chance of becoming low birth weight baby, but not statistically significant, Table 3.

Previous birth interval, the number of years between the last born baby and the previous sibling, was also considered in the bivariate analysis. In the bivariate analysis babies with previous birth interval less than two years were considered as a reference group. Having two years (OR: 0.533, 95% CI: 0.343, 0.829, P = 0.005) or three years (OR: 0.529, 95% CI: 0.336, 0.834, P = 0.006) of birth interval with the previous sibling were fetal factors that are associated with lower risk of low birth weight. The other group of babies with 4 or more years of spacing with previous sibling showed a non-significant decreased risk of becoming low birth weight babies, Table 3.

Becoming a twin or triplet baby is highly positively associated with becoming low birth weight. Twin babies when they are compared to singleton babies have an odds ratio of 14.28 times becoming a low birth weight, (OR: 14.28, 95% CI: 8.24, 24.73), with a *p-value* < 0.001.

DISCUSSION

Household socio-demographic factors

Except the having at least one mosquito net in household, all the household socio-demographic factors were not significantly associated with low birth weight. Some of the previous studies done on the effect of socio-demographic factors on birth weight found association. Level of income of a family is one of the issues strictly associated with the health condition of populations. It is a well understood fact that low socio-economic level of a family increases the occurrence of LBW [6].

A systematic review and meta-analysis concluded that adverse pregnancy outcomes (Low Birth weight and others) are associated with living in a deprived neighborhood. The study compared the risk of adverse perinatal outcomes in the least and most deprived income quintiles. The odds ratios for adverse perinatal outcomes in the most deprived neighborhood quintiles, compared to the least deprived once were significantly increased. Babies born from mothers in most deprived neighborhoods have 23% higher probability to be preterm and 31% to be small-for-gestational age [8].

The association between wealth of families and LBW is also seen in the most developed part of the world. Thought the intensity and pattern differs, a study on socioeconomic Inequalities in LBW in the United States, the United Kingdom, Canada, and Australia concluded socioeconomic gradients in LBW were observed in all the countries [19].

Multi-level analysis of the data that was

obtained from 2003 and 2008 Demographic and Health Surveys of Ghana showed mothers living in rural areas have higher chance of giving birth to a low birth weight baby. It increases the chance by 43 % [20].

Maternal factor

Many studies noted that the incidence of low birth weight increases in the extremes of women's reproductive age. Teen mothers and mothers aged older than 35 have higher probability of delivering low birth weight baby. After adjusting for socio-economic position very young mothers and older mothers, i.e. aged <16 or ≥35 have higher risk of giving birth to a low birth weight baby [21]. A study in Ethiopia , mothers age younger than 20 years at the time of delivery is associated with increased risk of giving birth to a low birth weighted newborn, mat (adjusted odds ratio = 3; 95 %, CI = 1.65–5.73) [2].

A report from Brazil, Sao Paulo state found an association between the number of antenatal visits by a pregnant mother and birth weight of a newborn for that specific pregnancy. Low birth weight and premature delivery incidence was lower in the mothers who have higher frequency of antenatal visits [22]. Demelash et al., 2015, South-East Ethiopia maternal lack of formal education was associeted with giving birth to a low birth weith newborn (AOR = 6; 95 % CI = 1.34–26.90), howevery in this study the level of eduction of the mother was not associtied with low birth wieght.

Fetal factor

In some reports the gender of the fetus has association with birth weight. Females have increased chance of being born low birth weight, in this study the association of being a female baby has a higher risk of low birth weight, but it was not statically significant [23].

Shah [24] observed firs born babies (babies that are born from nulliparous mothers) have increased unadjusted risk of low birth weight or small for gestational age. In this study second and third born babies has lower odds of becoming low birth weight.

CONCLUSION

Household characteristic such as ownership of mosquito net, maternal factors such as age of the mother number of antennal visits, starting of antennal visits by age of pregnancy, and fetal characteristics such as birth order, previous birth interval and multiple births were associated with low birth weight of a baby.

LIMITATION

The 2014 Zimbabwe MICS didn't collect data on the some important variables that can contribute to the birth weight of a newborn. Data on height of the mother and maternal illnesses during pregnancy such pre-eclampsia and eclampsia, anemia, and malaria and maternal weight gain were not collected on the survey. The survey collected data on intake of malaria prophylaxis, iron and foliate sublimation during pregnancies which are not accurate indicators of anemia situation. Finally, this report presents results of bivariate analysis. We believe that these findings give a reasonable picture of risk factors for low birth weight in the study area. At the same time, we point out that observed impacts of types of independent variables, and of individual variables, could change to some degree in multivariable analysis.

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