DETERMINANTS OF LOW BIRTH WEIGHT: A STUDY OF BIRTHS IN THE MIDLANDS PROVINCE OF ZIMBABWE

By

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Abstract

The study examined relationships between maternal risk factors and incidence of low birth weight using maternity registers for two hospitals in the Midlands Province in Zimbabwe over a four-year period. Only full term births were included in the analysis. A low birth weight incidence rate of (9.8%) was found among the 7 251 index births included in the study. Logistic regression analysis showed that extremes in maternal age (too young or too old), high parity and rural residence were positively associated with low birth weight. Low birth weight incidence rate varied only marginally over the four-year period.

Introduction

Birth weight is a measure of an infant's maturity and is used as a measure of an infant's relative probability of survival (Hale 1990). WHO regards an infant whose birth weight is less than 2.5kg as a high-risk infant. In developing countries 17% of all births have low birth weight (Ewbank and Gribble 1993:124). Zimbabwe has a low birth weight incidence rate of 12% and an infant mortality rate of 53 per 1000 (CSO 1995:219). Low birth weight accounts for half the number of deaths in the perinatal period (Ministry of Health 1995).

As a predictor of an infant's health status, birth weight has the advantage that it is a summary indicator of the aggregate effect of numerous socio-demographic risk factors for infant survival (Eberstein and Parker 1984; Venkatacharya and Teklu 1986; Kalan 1993). Maternal demographic characteristics in association with other social characteristics result in variation in birth weight patterns between social groups (Frenzen and Hogan 1982; Curtis et al. 1993).

In Zimbabwe successive Demographic and Health Surveys have shown that high-risk fertility behaviour is prevalent (CSO 1995). High-risk fertility behaviour is associated with poor pregnancy outcomes and high levels of infant and child morbidity and mortality. Identification of maternal risk factors associated with low birth weight is essential for planning purposes so that appropriate intervention measures can be implemented. This study examined variation in infant birth weight by maternal age, parity, infant's sex, year of birth, residence and hospital type proxying for socioeconomic status.

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Methodology

The baseline statistics for this study were compiled from maternity registers of two hospitals in the Midlands Province, namely, Gokwe District Hospital and Birchneough Hospital in Gweru. Gokwe District Hospital services surrounding rural areas the bulk of whose population derives a livelihood from agricultural activities. The maternity registrants are generally not covered by health insurance being mainly from low-income groups. By contrast, Birchneough Hospital services patients covered by health insurance with booking done through a doctor who subsequently supervises the birth.

The sample was made up of a total of 7 251 postpartum women drawn from maternity registers at Gokwe and Birchneough Hospitals for the years 1991 to 1994. Gokwe Hospital was selected because with an incidence rate of 11%, low birth weight in the district is a chronic problem (Ministry of Health 1995; CSO 1995). Birchneough Hospital was chosen for its urban location in order to compare pregnancy outcomes of women serviced by different health delivery services. The rationale for choosing the time reference period was based on the premise that the years selected covered an eventful period in the country. There was limited economic growth due to the introduction of ESAP (October 1990) and the devastating 1991/1992 drought. It was against this background that the impact of period effects on infants' birth weight was investigated.

The women's ages ranged from 13 to 58 years. Parities ranged from 0 to 14. To test digit preference in age reporting Whipple's Index was used. Employing the assumption of rectangularity in a 5-year age range the method yielded an index of 99.99. Since an index of 100 shows no preference for digits 0 and 5, the sample's age distribution showed no digit preference for 0 and 5 (Shryock and Siegel 1976). To be included in the sample, a woman had to meet the following criteria: (1) she must have had a singleton full term live birth for which a gestation period, weight and infant's sex was recorded and (2) a delivery case record showing maternal parity, age and usual place of residence at the birth of the index child. Using infants' birth weights a dichotomous dependent variable was created. Babies who weighed below 2 500 grams were classified as being of low birth weight while those who weighed 2 500 grams or more were classified as having normal birth weight.

The independent variables that were analyzed as predictors of infant birth weight were maternal age, parity, residence, infant's sex, year of birth and hospital type proxying for socioeconomic status. Five maternal age categories were used namely <20, 20-24, 25-29, 30-34 and 35+. Parity was dived into 4 categories: 1, 2-3 and 4-5 and 6+. Data used in the study covered a four year period. All predictor variables were entered in categorical form.

Analysis

Logistic regression analysis was used. The analysis makes use of the Wald statistic and the odds ratio. High figures for the Wald statistic indicate the importance of the independent variable in explaining variation in the dependent variable. The odds ratios shown in the tables indicate the change in the odds of an infant being born with a low birth weight due to

membership in a particular demographic subgroup compared to a reference group. An odds ratio of 1.0 indicates that the probability of low birth weight is higher for infants born to mothers in that particular demographic subgroup compared to the reference group. An odds ratio less than 1.0 indicates a lower rate of low birth weight among infants born to women in that particular subgroup relative to women in the reference group in the sample. The analysis was based on 2 models.

Model 1: Main Effects

All predictor variables were entered in the model except the period variable. In other words, the model controls for maternal age, parity, residence, socioeconomic status and infant's sex but does not control for period effects.

Model 2: Period Effects

In Addition to variables entered in Model 1, the period variable was entered in the model in order to control for period effects. If coefficients do not vary between Models 1 and 2, it would suggest that irrespective of year maternal characteristics like age group, parity, residence and socioeconomic status are associated with infant's low birth weight. If, however, there are no noticeable differences between the coefficients, then the effect of these variables is confounded by period effects. Larger coefficients in Model 2 would suggest that the effect of the predictor variables on birth weight is overstated when period effects are not controlled for (Gribble 1993).

Results and Discussion

Model 1: Logistic Regression Coefficients and Odds Ratios of Low Birth Weight (Main Effects)

Variable	B	S.E	WALD	df	Sig	Odds Ratio
Age			83.0944	4	.0000	
Age <20	.170	.1424	18.7662	1	.0000	1.8533
Age 20-24	-.0460	.1339	.1181	1	.7311	.9550
Age 30-34	-.2394	.1775	1.8200	1	.1773	.7871
Age 35+	.8349	.1721	23.5342	1	.0000	2.3045
Parity			26.7888	1	.0000	
Parity 1	.601	.1050	11.7724	1	.0006	1.4335
Parity 4-5	-.3070	.1517	4.1181	1	.0424	.7350
Parity 6+	.2792	.1776	2.4719	1	.1159	1.3231
Hospital(Gokwe)	.4751	.1227	15.0191	1	.0001	1.6087
Sex (female)	.2757	.0751	13.4809	1	.0002	1.3175
Constant	-2.9929	.1497	399.5917	1	.0000	

Source: Logistic Regression Output

With a Wald statistic of 83.09 maternal age is the most important predictor of low birth weight. The relationship between age of mother and low birth weight was found to be curvilinear. Babies born to mothers aged 35 years and older were 1.3 times more likely to have low birth weight compared to babies born to women aged 25-29 years (reference group). The odds of having low birth weight for babies born to teenage mothers were 85% greater than those for babies born to mothers aged 25-29. By contrast the odds of low birth weight for babies born to women aged 20-24 and 30-34 are not statistically significant indicating no difference in the likelihood of low birth weight between each of the two groups on the one hand and the reference group on the other

Parity with a Wald statistic of 26.78 was also found to be an important predictor of low birth weight. The odds of low birth weight were high among first and higher order births (6 children and above). First births were 43% more likely to have low birth weight than the reference group (parity 2-3). The association between sex and the odds of low birth weight was positive and significant at 1% level. Female babies were 32% more likely to have low birth weight relative to male babies. The relationship between hospital type and the odds of low birth weight was also positive and significant at 1%. An odds ratio of 1.61 means that a baby born at Gokwe Hospital was 61% more likely to have low birth weight relative to a baby born at Birchneough Hospital.

Model 2: Logistic Regression Coefficients and Odds of Low Birth Weight (Controlling for Period Effects)

Variable	B	S.E.	WALD	df	Sig	Odds Ratio
Age			82.9882	4	.0000	
Age <20	. 6320	.1422	19.7526	1	.0000	1.8814
Age 20-24	-.0390	.1340	.0847	1	.7710	.9617
Age 30-34	- .2396	.1777	1.8190	1	.1774	.7869
Age 35+	.8226	.1724	22.7594	1	.0000	2.2765
Parity			27.8423	1	.0000	
Parity1	.3729	.1049	12.6369	1	.0004	1.4519
Parity 4-5	- .2722	.1533	3.1520	1	.0758	.7617
Parity 6+	.3372	..1800	3.5110	1	.0610	1.4010
Hospital(Gokwe)	.5151	.1242	17.2142	1	.0000	1.6739
Sex (female)	.2782	.0751	13.7018	1	.0002	1.3207
Year			5.3892	1	.1459	
1991	.1109	.1082	1.0551	1	.3055	1.1173
1992	.2142	.0976	4.8189	1	.0281	1.2389
1993	.0292	.1127	.0673	1	.7954	1.0296
Constant	-3 .1464	.1689	346.857 1	1	.0000	

Comparison of Model 1 and Model 2

	MODEL 1	df	MODEL 2	df
-2 Log likelihood	4946.109*	7241	4940.744*	7238
Model Chi-square	245.681*	9	251.046*	12
Improvement	245.681*	9	251.046*	12

*** significant at less than 1%**
Source: Logistic Regression Output

After adding the period variable, only the parameter estimate for1992 was found to be statistically significant from zero ($p < .05$). In addition, the relationship between higher parity (6 children and above) was found to be statistically significant at 10% whereas in model.1 the relationship was not significant. Otherwise the model remained unchanged in terms of statistical significance of the change in the log likelihood ratio, the statistical significance of the parameter estimates and the direction of the effects. This suggests that maternal age; parity, residence and socioeconomic status have an effect on infant's birth weight whether or not period effects are controlled for. The years 1991 and 1992 only marginally raised the odds of low birth weight compared to 1994.

Conclusion

The number of variables that affect low birth weight included in this study is not exhaustive. Most of the variables were used as proxies for biodemographic, socioeconomic and environmental factors that affect birth weight. The study found that of the 7 251 index births, 9.8% had birth weight below 2500 grams. The low birth weight rate would have been higher if the study had included preterm births. The CSO (1995) gives the national low birth weight incidence rate of 12.1%. Because of the causal link between birth weight and infant mortality such a high incidence of low birth weight is a cause for concern. Many environmentally and socially based determinants of low birth weight can be mediated through characteristics of the mother before or during pregnancy by systematically and selectively working on the chain of events from risk to outcome (Ministry of Health 1995). Women must be given alternatives to child bearing through education, employment, social and economic empowerment. Information contained in hospital maternity records showed that these records are a prolific source of demographic data with immense analytical potential. But currently in Zimbabwe such records do not contain information on maternal attributes such as religion, education level, employment status and income, which could have increased the number of variables to be analyzed.

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