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Influence of maternal factors and sex of newborn on birthweight

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Summary

This paper explores the effective use of six characteristics of the mother and one characteristic of the baby in predicting the birth weight of the baby using stepwise multiple regression. Three variables, i.e. the weight of the mother, the sex of the baby and the number of antenatal visits the mother made to the clinic, significantly predicted the birthweight of the baby. It is possible that other more important variables not considered in this model might better predict the birthweight of the babies, since only 14.2% of the variance in the dependent variable was explained by the three variables, leaving 85.8% of the variance unexplained.

Key words – Birth weight, multiple regression, antenatal visits, maternal factors.

Introduction

It is well documented that maternal factors like age at pregnancy, height of mother and parity and birth interval influence the birthweight of babies.[1,2] The birthweight of the baby is also influenced by anaemia, infection, malnutrition, frequent pregnancies, early marriages, short intervals between birth, parity and other social and biological characteristics of the mother. External factors such as the nutritional status of the mother, cigarette smoking and high altitudes also affect the birthweight of the baby.[3] One study showed that birthweight varies inversely with the height of the mother: a tall mother has a child of lower birthweight.[4] Similarly, parity is also shown to influence birthweight. The birthweight of the offspring of primiparae is significantly lower than that of children of multiparae after 32 weeks of gestation.[5]

Materials and Methods

Antenatal cards from Health Centres in Kuala Kurau and Jalan Bharu in Krian District, Perak were used. In all, 292 complete antenatal records were compiled for this study. All information on maternal factors were recorded from these cards. The maternal height and weight registered in the first month of pregnancy was recorded.

After collecting data on the maternal characteristics and the respective birthweights of the babies, regression analysis was carried out using SPSS. The birthweight of the baby was taken as the dependent variable. The independent variables were the mother's age, weight, height, her gravida and para, the baby's sex and the number of antenatal visits. After obtaining the regression equation, the stepwise procedure was carried out on the same data to identify which variables gave the maximum explained variance. All possible combinations of the variables taken from the original seven independent variables were examined. Certain variables were forced into the regression equation. The final regression equation contained three variables: the weight of the mother, sex of the baby and the number of antenatal visits. A residual analysis, where each variable was plotted against the independent variable, showed most of the residuals falling in a horizontal band centered around the abscissa.

Using the regression model, assumptions were made that maternal factors like height and weight of the mother, sex of the baby and the number of antenatal visits could be used to predict the birthweight of the baby. Although multicollinearity exists between some of the variables, they were considered together because of the importance of these factors.

Results

Table I shows the mean ($\bar{x}$) and standard deviation (SD) of the independent variables and the dependent variable. The mean height of the mothers in this study was 150.8 cm, their mean weight 52.0 kg. The mean age was 28.5 yrs., the mean gravida 3.9, while the mean para of the mother was 2.7.

Table I

Maternal Variables, Their Mean and Standard Deviations

Variable	**Mean ($\bar{x}$)**	**Standard Deviation (SD)**
Weight of mother	52.06 kg	7.96
Height of mother	150.80 cm	6.44
Age of mother	28.59 yrs	5.99
Gravida of mother	3.96	2.76
Para of mother	2.76	2.58
Number of antenatal visits made by mother	3.92	2.45

Number of Cases = 292

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Table II is a correlation matrix among all the variables selected for the study. Multicollinearity exists between gravida and para (0.977). There is high positive correlation between age and gravida. Positive correlation is also noticed between age and para.

Table II

Correlation Matrix of the Variables

	Wt. of mother	Ht. of mother	Age of mother	Gravida	Para	No. of Antenatal Visist	Sex of Baby	Weight of Baby
Weight of mother	1.000	0.414	–0.055	–0.022	–0.028	–0.067	0.070	0.331
Height of mother	0.414	1.000	–0.134	–0.161	–0.174	–0.057	0.067	0.132
Age of mother	0.055	–0.134	1.000	0.688	0.687	–0.012	–0.065	0.025
Gravida	–0.022	–0.161	0.688	1.000	0.977	0.047	–0.022	0.050
Para	–0.028	–0.174	0.687	0.977	1.000	0.058	–0.031	0.049
No. of Antenatal visits of mother	–0.067	–0.570	–0.012	0.047	0.058	1.000	–0.070	0.126
Sex of Baby	0.070	–0.067	0.065	–0.022	–0.031	–0.070	1.000	–0.127
Weight of Baby	0.331	0.132	0.025	0.050	0.049	0.126	–0.127	1.000

Table III shows the regression equation after using stepwise regression. It accepted three variables – the mother's weight, the baby's sex and the number of antenatal visits in the equation, which gave it the explained variable. All other variables such as the height of the mother, age of the mother and para and gravida of the mother were rejected from the question.

Table III

Multiple Correlation Coefficient, Coefficient of Determination and the Regression Equation

Multiple R	0.38929
R^2	0.15155
Adjusted R^2	0.14271
Standard Error	0.43204

Variable	B	S.E.B.	Beta	T	Sig. T
Weight of mother	0.02052	3.1931	0.35043	6.428	0.0000
Sex of Baby	–0.12243	0.04709	–0.14176	–2.6000	0.0098
No. of visits	0.02560	0.01037	0.13930	2.555	0.0111
Constant	1.97410	0.17581		11.229	0.0000

Y (weight of baby) = 1.97410 + 0.02052 (Weight of mother) + 0.02650 (No. of visits) – 0.12243 (Sex of baby)

Sex of Baby Female = 1 Male = 0

The correlation coefficient (multiple R) was only 0.389 which indicated there was little correlation between the dependent variable and the independent variables. The coefficient of determination or the adjusted R^2 was only 0.142 showing that only 14.2% of the variance in the dependent was explained by the variables. The coefficient of determination explains the degree of association that exists between the dependent variable and the independent variables. The regression equation was significant as shown in the analysis of variance table.

The regression equation was obtained as follows:

y (wt. of baby) = 1.97410 + 0.02052 (wt. of mother) + 0.02650 (No. of A/N visit) – 0.12243 (sex of baby)

where the sex of baby is '1' for female and '0' for male.

Table IV shows the analysis of variance table. The regression equation is significant because of the high F value.

Table IV

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	3	9.60213	3.20071
Residual	288	53.75742	0.18666

F = 17.14748 *Significant F = 0.0000*

Discussion

The significance of predicting the birthweight of babies is to detect mothers who are more likely to have low birth babies or babies with higher risk because the association between perinatal mortality and low birth weight is well documented. Infants weighing 2500 gm and less have 30 – 35 times higher risk of mortality than infants over 2500 gm.

Prediction of birthweight using seven characteristics (six maternal characteristics and one of th baby's) was done using multiple regression. The correlation coefficient (R) was only 0.39 which showed that there was little correlation between the dependent and independent variables. The coefficient of determination (R^2) was only 0.1427 which meant only 14.27% of the variance in the regression was explained by the variables whereas the remaining 85.73% of the variance was unexplained. Although many other studies have shown that the age of the mother, weight of the mother and gravida and para variables can be used to determine the weight of the baby[1-4], this study showed that prediction of birthweight using the above variables was low.

Moreover, the stepwise regression analysis on all the variables showed that only three variables – the weight of the mother, the sex of the baby and the number of visits made to the clinic – gave a combined coefficient of determination (R^2) of 0.1427. The other variables like height, para, gravida and age of the mother were rejected from the regression equation, which meant that these factors played a less significant role in the determining the birthweight of the baby, although one study found that the mean birthweight was found to increase with maternal age and birth order.[6]

Studies have shown that the weight of the mother is a useful indicator of birth weight. The heavier the weight of the mother the greater the birthweight. It may be that weight is an indirect indicator of nutritional status of the mother. Sex of the baby also affects birthweight. Several studies have shown that male babies have a higher mean birthweight than female babies.[7] Thus knowing the sex of the baby helps to predict birthweight. Although the number of antenatal visits may only be an indirect indicator of the health status it does seem to have an influence on the birthweight. The health education and the nutritional talks given in the health centre can affect the nutritional awareness of mother which indirectly affects birthweight.

Although several factors can affect the birthweight of the newborn, only the weight of the mother, the sex of the baby and the number of antenatal visits made by the mother, seem to be significant in this study. Emphasis to improve the weight of mother and increasing the number of antenatal visits is important. Although these factors are important, we must realize, however, that the regression analysis only shows the relationship of association, and not necessarily a cause and effect. It is therefore not suggested that the weight of the mother, the sex of the baby and the number of antenatal visits had any casual effect on the birthweight, only a relationship of association.

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