# The Relationship Between Maternal Characteristics and Child Birthweight

## Introduction

Data were collected in a sample of 189 newborns to determine if mother's age (years), mother's weight (lbs), mother's smoking status during pregnancy (smoker/non-smoker) and mother's hypertension status (history vs. no history of hypertension) were associated with birthweight (g).

## Methods

Descriptive statistics were examined for maternal characteristics and children's birthweights. Correlations were computed, and multiple linear regression modeling used to examine the relationship between birthweight and mother's age, weight, smoking status and history of hypertension; the model is shown below. A histogram and a normal probability plot of model residuals were examined to assess the normality assumption. All inference-making was two-sided, with a significance level of 0.05.

Model: $Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + E$, where
Y = birthweight (g)
$X_1$ = mother's age (years)
$X_2$ = mother's weight (lbs)
$X_3$ = mother's smoking status (1=smoked during pregnancy, 0=did not smoke)
$X_4$ = mother's hypertension status (1=history of hypertension, 0=no history of hypertension)
E: random error, assumed ~ $N(0, \sigma^2)$
$\beta_0$ = true y-intercept, $\beta_i$ = true slope associated with $X_i$, i=1,2,3,4, adjusted for the other predictors

## Results

In our sample of 189 newborns the mean birthweight was 2,944.7 g (sd 729.2g) (Table 1). The mean mother's age was 23.2 years (sd 5.3 years), and mean mother's weight was 129.8 lbs (sd 30.6 lbs). Seventy-two women (38.1%) smoked during pregnancy and 12 (6.3%) had a history of hypertension.

The correlation between birthweight and mother's weight is weak (r=0.19, Figure 1) but statistically significant (p=0.01); there does not appear to be a linear association between birthweight and mother's age (correlation 0.09, p = 0.22).

The regression model was significant (overall F-test p-value < 0.001), with an adjusted R-square of 0.08. All predictors except mother's age were significantly associated with birthweights; regression coefficient estimates and standard errors, and p-values for coefficient partial tests are shown in Table 1.

Table 1. Mother's Characteristics and Child's Birthweight (n=189)

| Characteristic | Mean (SD) or n (%) | Min, Max | Adjusted Regression Coefficient Estimate (Std. Error, p-value)* |
|---|---|---|---|
| Birthweight (g) | 2,944.7 (729.2) | 709, 5001 | -- |
| Mother's age (years) | 23.2 (5.3) | 14, 45 | 5.4 ( 9.8, 0.582) |
| Mother's weight (lbs) | 129.8 (30.6) | 80, 250 | 5.2 ( 1.8, 0.004) |
| Mother: smoked during pregnancy | 72 (38%) | | -209.9 (105.4, 0.048) |
| Mother: history of hypertension | 12 (6%) | | -597.7 (215.8, 0.006) |
| Regression model intercept | | | 2263.5 (299.9, <0.0001) |

* P-value is for the partial t-test of the regression parameter.

The histogram of regression residuals (Figure 2A) and the normal probability plot (Figure 2B) were consistent with normality.

## Conclusions

In our sample of 189 newborns, there was a significant linear association between birthweight and mother's weight, smoking status and hypertension status. On average, for each 1-pound increase in mother's weight, birthweight increased, on average, by 5.2 g (std. error 1.8g, p = 0.004), adjusting for mother's age, smoking status and history of hypertension. Birthweight was 209.9 g lower, on average, in newborns of mothers who smoked during pregnancy (std. error 105.4g, p = 0.048), adjusting for mother's age, weight and hypertension status. In addition, birthweight was 597.7 g lower (std. error 215.8 g, p = 0.006), on average, if the mother had a history of hypertension, adjusting for mother's age, weight and smoking status. Mother's age was not significantly linearly associated with birthweight (p = 0.582)

The model, while statistically significant (overall F-test p-value < 0.001), had poor fit, with an adjusted R-square of 0.08, which is a limitation of this analysis. Considerably larger sample sizes and additional maternal and pregnancy characteristics may be needed in future studies in order to predict birthweight with accuracy.

Figure 1: Correlation Between Birthweight (BWT) and Mother's Age and Weight (WT)

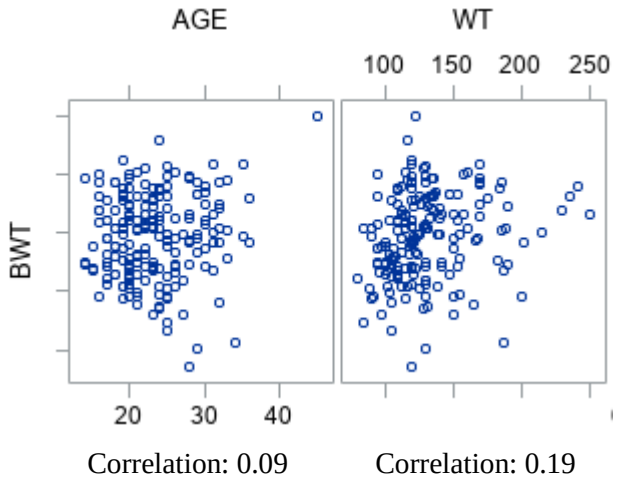


Figure 2: (A) Histogram and (B) Normal Probability Plot of Model Residuals