

PREDICTION OF BIRTHWEIGHT



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1. The Problem

Nowadays, doctors have stressed out the importance of prenatal healthcare, which mainly consists in avoiding bad habits such as smoking and consuming alcohol during pregnancy. Prenatal healthcare is meant to improve well-being of newborns, which can often be measured as birthweight. A birthweight less than 2,500 grams is diagnosed as low birthweight and less than 1,500 is considered very low birthweight.¹ The birth weight of the baby can be affected by the mother's nutrition as well as genetic factors and external factors such as parents' age and education, month prenatal care began, total number of prenatal visits.

2. Methodology

As public health consultants, our report is meant to analyze which variables can affect birthweight of newborns, understanding useful insights in order to increase newborns' well-being. Furthermore, a model has been implemented in order to predict birthweight. The report will proceed as follow: first, presenting key insights based on our data explanatory analysis followed by recommendations on what kind of actions should be taken. As we analyzed the data, we had seven missing values and we decided to impute the missing values by using median of each column. After understanding the data, we determined the outliers.

3. Key Insights

According to our data, 25% of our babies were born less than 2,900 grams. and 75% of our babies were born less than 3,700 grams.

^{1,2} Stanford Children's Health - Lucile Packard Children's Hospital Stanford. (March 06, 2019). *Very Low Birthweight*. Retrieved from <https://www.stanfordchildrens.org/en/topic/default?id=very-low-birthweight-90-P02424>

³ EHR National Symposium. (March 06, 2019) *Older fathers associated with increased birth risks*. Retrieved from <https://med.stanford.edu/news/all-news/2018/10/older-fathers-associated-with-increased-birth-risks.html>

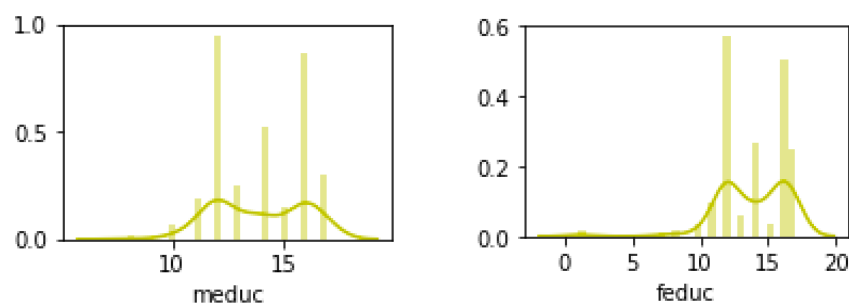
⁴ National Healthy Start. *Infant Mortality, Low Birthweight and Racial Disparity*. Retrieved from <http://www.nationalhealthystart.org/site/assets/docs/Infant%20Mortality%20Low%20Birthweight.pdf>

3.1 Parents Age

During our explanatory analysis, we found several interesting insights. Our dataset was provided with both mothers' and fathers' age, after conducting an accurate research, we found out that mothers who are younger than 17 or older than age of 35 are more likely to have a baby with very low birthweight.² Even fathers' age is crucial, from the data of more than 40 million births, scientist at Stanford have linked older fathers to health risk for their infants.³ In our given data we try to see the relationship between these two variables (mothers/fathers age) and birthweight. Surprisingly we did not find same patterns but just a weak relationship, that might be either that our sample size data was very small (196 births) or the effect of new healthcare technologies on assisting risky pregnancies. However, when the age is combined (sum of parents age), inevitably we saw a stronger relationship, confirming the effect of parental age.

3.2 Parent Education

During the EDA, we analyzed how parents' education affects the birthweight of a newborn. The majority of parents are educated because the data is considered from US population which is a highly developed country. As we can see in the two graphs below, the peak points are around 12 (high school degree) and 16 (college school degree) for both meduc (mother's education) and feduc (father's education). There seem to be the birth rates are higher right after high school degree and college degree for both mother and father.



^{1,2} Stanford Children's Health - Lucile Packard Children's Hospital Stanford. (March 06, 2019). *Very Low Birthweight*. Retrieved from <https://www.stanfordchildrens.org/en/topic/default?id=very-low-birthweight-90-P02424>

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⁴ National Healthy Start. *Infant Mortality, Low Birthweight and Racial Disparity*. Retrieved from <http://www.nationalhealthystart.org/site/assets/docs/Infant%20Mortality%20Low%20Birthweight.pdf>

3.3 Cigarettes and Alcohol Consumption

Some of the insights that we were able to extract from our dataset after conducting an explanatory data analysis is that the birthweight of the child was strongly affected by alcohol and cigarette consumption meaning that the more alcohol and cigarettes are consumed, the lower is the birthweight. However, we were questioning the impact of cigarette consumption because we were expecting it to be higher. We conducted a further research in order to confirm our results, because we believed that smoking was a habit that could have a very high impact on the birthweight. We assumed that cigarette consumption could be related to the father instead of the mother.

3.4 Race

Based on our external research we found out that even race could affect baby birthweight. It has been proven that African American babies are twice as likely to be low birthweight.⁴ According to with these findings we tried to see the same patterns in our dataset, but we did not find any relationship between parents' race and birthweight.

3.5 Moth Prenatal Care Began

According to our analysis, the sooner prenatal care began the better the neonatal health (birthweight). Although there was no significant effect on birthweight during the data exploration, it plays a crucial role for the model accuracy in order to predict birthweight.

^{1,2} Stanford Children's Health - Lucile Packard Children's Hospital Stanford. (March 06, 2019). *Very Low Birthweight*. Retrieved from <https://www.stanfordchildrens.org/en/topic/default?id=very-low-birthweight-90-P02424>

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4. Recommendations

Based on our explanatory data analysis we built a model that is able to predict infants' birthweight. The ability to predict the birthweight was tied to number of cigarettes smoked per day and consumption of alcohol. The accuracy of the model was further improved by adding parents' age, beginning month of prenatal care and parents' education.

Such characteristics led to an accuracy of nearly 70%, giving an acceptable prediction of the health of a newborn baby.

To conclude, our model is based on realistic variables that are aligned with our external research, proving that smoking and drinking during pregnancy is highly discouraged, and furthermore, parental age effect, beginning month of prenatal care and parents' education play a crucial role in the health of newborns.

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