Analysis of Birth Weight Given Maternal Smoking Status

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1. Introduction

The purpose of this study was to analyze data from the Child Health and Development Studies dataset to determine if there was a significant difference between birth weights of babies born to mothers who smoked during pregnancy and mothers who did not smoke during pregnancy. The dataset contains the birth weight of babies born between 1960 and 1967 in Oakland, California. It is widely documented that smoking during pregnancy can lead to health complications for the newborn, including lower birth weights, which is what this study will be focusing on.

We focused on the following questions:

1. What is the distribution of birth weights for babies of smoking mothers and non-smoking mothers?
2. Are there meaningful differences between the two distributions?
3. What is the frequency of birth weight less than 100 ounces in each group?

2. Analysis

2.1 Data Processing and Summaries

Methods:

We prepared the dataset for analysis by removing missing and error values (denoted in the dataset with impossible values) as well as removing extreme outliers (mothers with height greater than 90 inches and weight greater than 300 pounds were excluded). Smoking status was cleaned to include only valid values (0 = non-smoker, 1 = smoker).

Analysis:

- Birth Weight (ounces):
    - Range: (55, 176)
    - Mean: 119.6
    - Median: 120
- Smoking Status:
    - 46.4% smokers, 53.6% non-smokers

The histograms of each variable seem to indicate that each had a reasonable distribution, with only maternal weight having some skewness to the right.

Conclusions:

Initial data exploration provides an overview of the distributions of the key variables. All variables have reasonable distributions, though some outliers and error values were detected and removed during preprocessing. Therefore, the

dataset appears to provide sufficient variability to allow for comparisons between the birth weights of babies born to smokers and non-smokers.

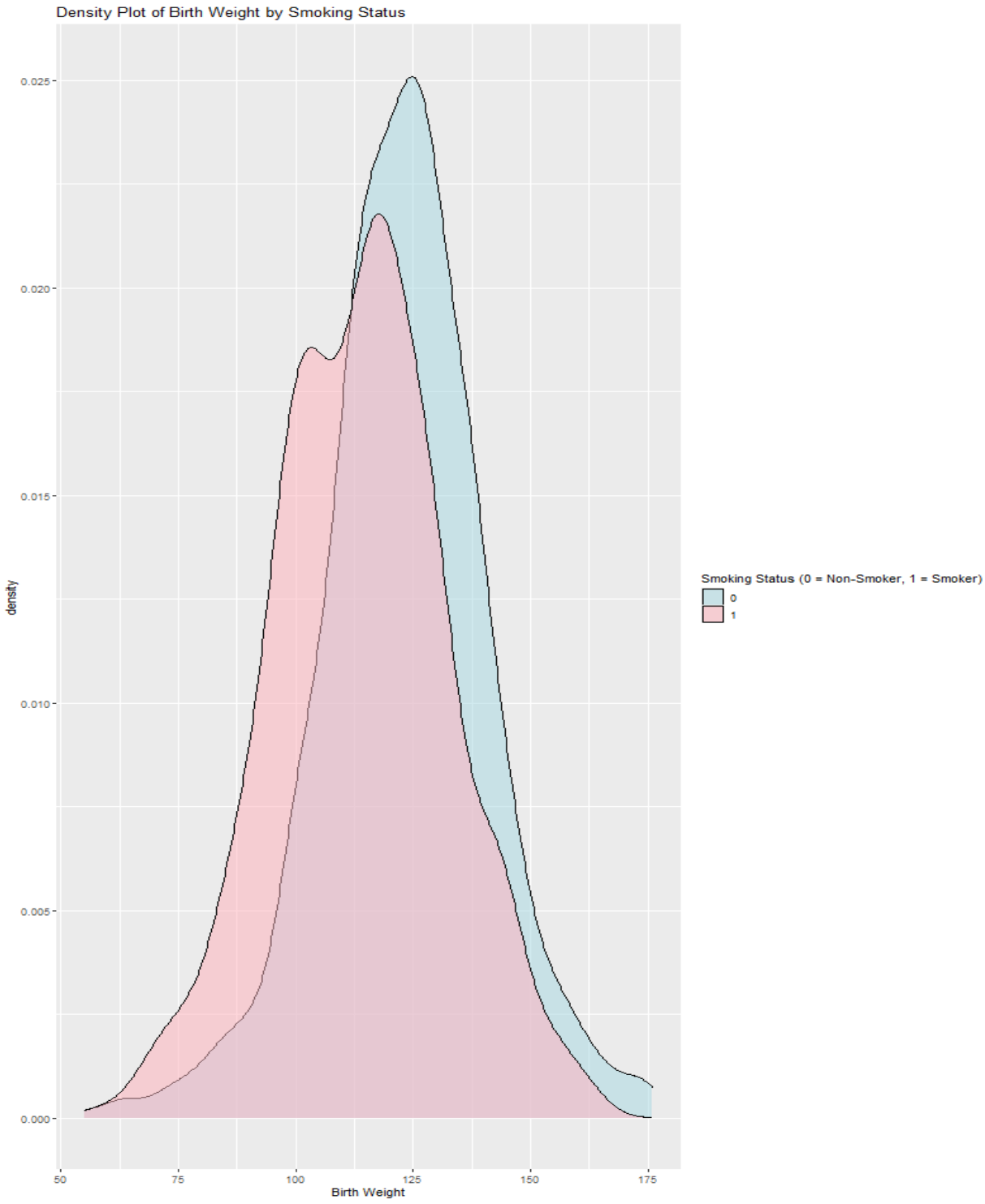
2.2 Comparison of Birth Weights Between Smokers and Non-Smokers

Methods:

The birth weights of babies born to smokers and non-smokers were summarized using mean, median, quartiles, and standard deviation. Boxplots and density plots were created to serve as visual comparison between the distributions of birth weight between the two groups.

Analysis:

Birth Weight (oz)	Smokers	Non-Smokers
Min	58	55
Max	163	176
Mean	113.82	123.09
Median	115	123
Standard Deviation	17.42	18.29



The density plot highlights the overall distribution of birth weights. Non-smokers tend to have heavier babies, as shown by the rightward shift in their density curve, while the distribution for smokers is centered at a lower birth weight.

Conclusions:

Babies born to smokers tend to have lower birth weights compared to those born to non-smokers. Both the mean and median are lower for babies of smokers, and the density plot shows lower birth weights among the smoking group.

2.3 Incidence of Lower Birth Weight

Methods:

Low birth weight was defined as being less than 100 ounces. The incidence of low birth weight was determined for both smokers and non-smokers.

Analysis:

Smokers: 18.36% had a birth weight under 100 ounces.

Non-Smokers: 5.32% had a birth weight under 100 ounces.

Conclusions:

Babies born to smokers are over three times more likely to have low birth weights compared to those born to non-smokers. This confirms the significant effect that maternal smoking has on birth weights.

3. Advanced Analysis

While the focus of this report is the impact of smoking on birth weight, an additional analysis could examine the effect that maternal smoking has on gestation length. Given that premature birth is known to have negative impacts on the long term health of the baby, future analyses could investigate whether smoking causes premature birth at a higher rate. We could additionally incorporate the birth weight variable by studying whether smoking impacts birth weight independently of gestation period.

An advanced analysis could use a linear regression model to control for gestation length and see if smoking has an independent effect on birth weight.

4. Conclusion

This analysis demonstrates that maternal smoking is strongly associated with lower birth weights. Babies born to smokers weigh less on average compared to the babies of non-smokers, and the incidence of low birth weight is much higher in the smoking group.

While the data provides clear evidence of the negative impact of smoking on birth weight, further studies could explore other factors such as maternal nutrition or usage of marijuana. Additionally, more advanced models could help narrow down the specific causes of lower birth weights, as denoted in section 3.