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**INTRODUCTION**

There are many sources of dust in our homes including pet dander, dead skin cells, forgotten food crumbs, pollen, and dirt from outside. Dust is only one source of particulate matter in the air, any form of combustion also produces particulate matter which includes things such as burning candles or tobacco. Another source of particulate matter (PM) comes from cooking which releases PM 2.5. Research suggests that cooking with a gas stove produces double the amount of PM 2.5 compared to cooking with an electric stove (Hu et al. 2012). These findings lead me to hypothesize that dust sensors will show a significant difference in detection between outside, homes with electric stoves, and homes with gas stoves with outside sensors detecting the lowest concentrations of particles in the air and inside homes with gas stoves detecting the highest concentrations.

**METHODS**

For the study, data was collected in 2020 with the Particle Argon and included a Grove dust sensor, a Grove air quality sensor, and a Grove temperature and humidity sensor. These sensors were placed in locations chosen by students with some being inside homes and some being placed outside. According to the manufacturer, the dust sensor detects particle sizes over 1 micron (PM 1) and 2.5 micron (PM2.5) in size. This means that the dust sensors are capable of detecting particulate matter produced by stoves.

To do my analysis, I used RStudio. I first cleaned up the data by replacing all of the empty cells in the column “Stove” to say “None”. To create a linear regression, I had to create dummy variables to indicate the stove type. After doing that, I created the linear regression and found that the dummy variable indicating no stove present was highly colinear with the other variables. I removed that variable and ran the model again then analyzed the model with an analysis of variance (ANOVA). I also created a box plot and calculated the mean dust ratio values and standard deviations for each stove type.

**RESULTS**

The mean value of the dust ratio was 0.54 ±79.51 for homes with electric stoves, 0.70 ± 54.10 for homes with gas stoves, and 0.80 ± 40.90 for outdoor sensors (Fig 1). From the linear regression model, the coefficient of electric stoves was -0.26 (p-value < 0.001) and the coefficient of gas stoves was -0.09 (p-value < 0.001). The variable indicating no stove present was highly colinear and was excluded from the model.

**CONCLUSIONS**

The ranking of amount of dust detected by the sensors in descending order was outside, inside with gas stove, and inside with electric stove. These findings do not support my initial hypothesis that the levels of dust detected would occur in the descending order of inside with electric stove, inside with gas stove, and outside.

There are a variety of unmeasured factors which may have influenced the amount of dust detected in each location. One factor is when the sensors were active. With pollen being a component of dust, if sensors were active during spring when the trees and flowers were releasing pollen, that would increase the amount of dust which may or may not be a proportional difference between outdoor areas and indoor areas. Along that same vein is the location of outdoor sensors. If sensors were placed near many plants such as in a forest or a garden, especially when they were releasing pollen, then that might increase the amount of dust sensed by those sensors compared to outdoor sensors placed in a yard with relatively few plants releasing pollen.

**LITERATURE CITED**

Hu, Tianchao, et al. “Compilation of Published PM2.5 Emission Rates for Cooking, Candles and Incense for Use in Modeling of Exposures in Residences.” Osti.Gov, 1 Aug. 2012, www.osti.gov/biblio/1172959.

Chart, box and whisker chart

Description automatically generated

**Figure 01.** Boxplots showing the distribution of data collected from the Grove dust sensors. Sensors are grouped together by their placement being either in a home with an electric stove, in a home with a gas stove, or outside with no stove present.