An Analysis of NHANES Data

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Introduction

The National Health and Nutrition Exam Survey (NHANES) is administered by the National Center for Health Statistics, which is a branch of the Center for Disease Control in the United States. The target population of NHANES is people who live in the United States (of any age). Each year, NHANES randomly selects 7,000 residents in the US to participate in NHANES. The participation of those selected is confidential and voluntary. Once selected residents opt-in to NHANES, they undergo a personal interview and "standardized health examination", where researchers can collect health information.

The NHANES data that we are analyzing has 10,000 observations and 75 variables which were collected from 2009-2012. The observational unit is a resident of the United States that is six months or older. For our project, we will only be using 10 variables – 7 quantitative and 4 categorical – that are listed below.

Quantitative

1. Pulse *(60 second pulse rate)*
2. Testosterone *(recorded in ng/dL for patients 6 and older; no data for 2009-2010 was recorded)*
3. Poverty *(A ratio of family income to poverty guidelines. Smaller numbers indicate more poverty)*
4. Age *(all subjective 80 or older are recorded as 80)*
5. Physactivedays *(Number of days in a typical week that partipant does moderate or vigorous-intensity activity. Reported in patients 12 years or older)*
6. AlcoholDay *(Average number of drinks consumed on days that participant drank alcoholic beverages. Reported for participants aged 18 years or older)*
7. HHIncomeMid *(Variable was partitioned into blocks with the smallest one being (0,4999) and the largest block being 100,000 or more, the median of each block was then used to estimate income)*

Categorical

8. Gender *(sex of study particpant coded as "male" or "female")*
9. Race1 *(Reported race of study participant: Mexican, Hispanic, White, Black, or Other)*
10. Education *(Reported for ages 20 or older. Categories to choose from are "8thgrade", "9-11thgrade", "Highschool", "SomeCollege", or "CollegeGrad")*
11. Depressed *(Self reported number of days where participant felt down, depressed or hopeless. Reported in patients 18 and olders with categories of "none", "several", "majority (more than half the days)", or "almostall")*

Our response variable will be pulse – which is the 60 second pulse rate of a participant. We will run pulse against a variety of explanatory variables to assess linear fit.

Given many of our variables (such as depressed, alchohol, and education) were not collected for adolescents, we will be limiting the scope of our population to adults (>18 years old) who live in the US.

Summary Statistics

```
## # A tibble: 11 x 5
##    skim_variable  numeric.mean numeric.sd complete_rate numeric.p50
##    <chr>                 <dbl>      <dbl>         <dbl>       <dbl>
##  1 Gender                NA         NA            1            NA
##  2 Depressed             NA         NA            0.667        NA
##  3 Education             NA         NA            0.722        NA
##  4 Race1                 NA         NA            1            NA
##  5 Age                   36.7       22.4          1            36
##  6 HHIncomeMid        57206.     33020.           0.919     50000
##  7 Testosterone         198.       227.           0.413        43.8
##  8 PhysActiveDays         3.74       1.84         0.466         3
##  9 Pulse                 73.6       12.2          0.856        72
## 10 Poverty                2.80       1.68         0.927         2.7
## 11 AlcoholDay             2.91       3.18         0.491         2
```

Single Variable Distributions

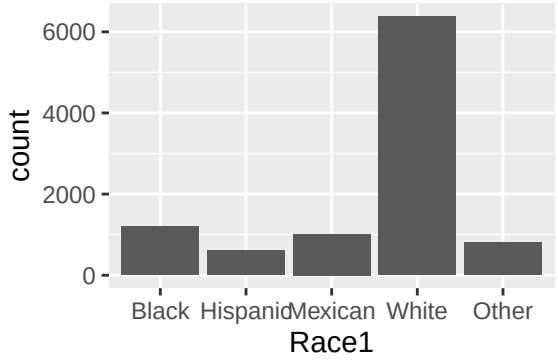


Figure 1: Distribution of Participant Race

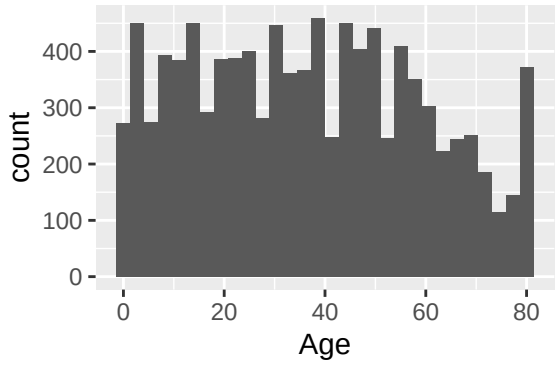


Figure 2: Dstribution of Participant Age

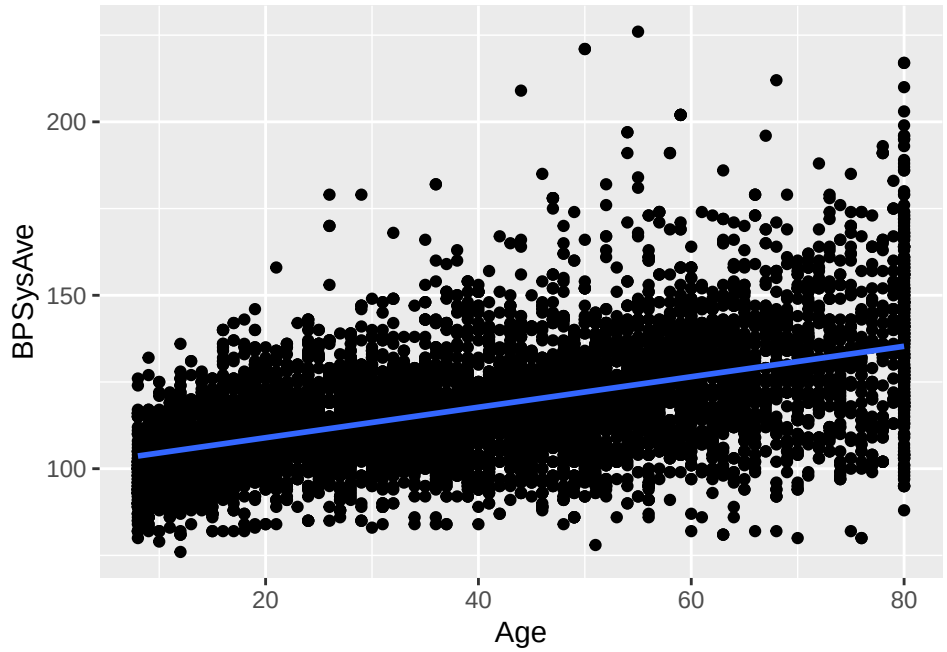
Single Linear Regression

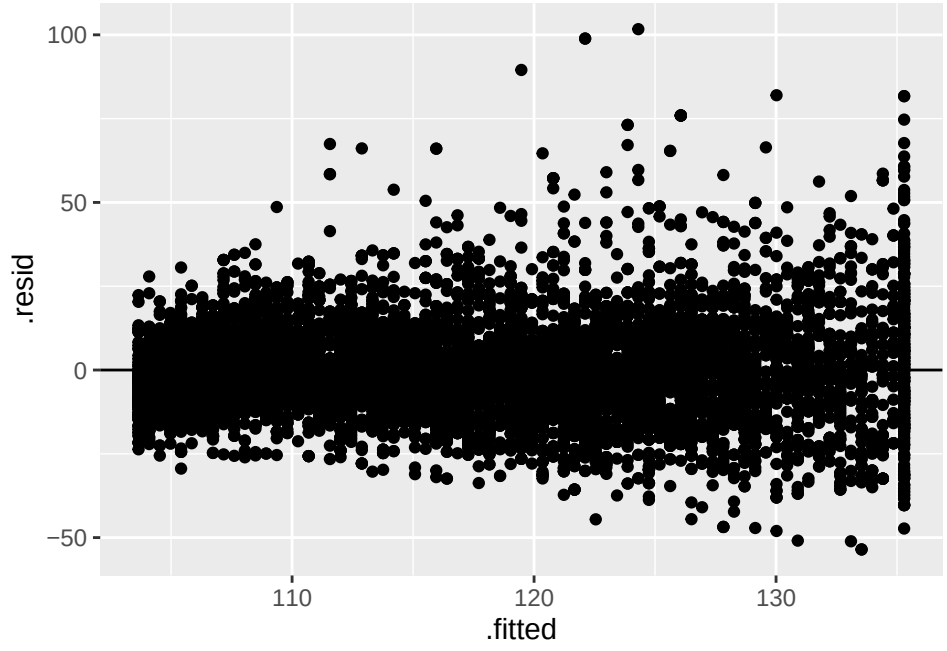
Test Hypothesis

LINE Assumptions

Confidence Intervals for Mean and Individual Response

Fit Assessment



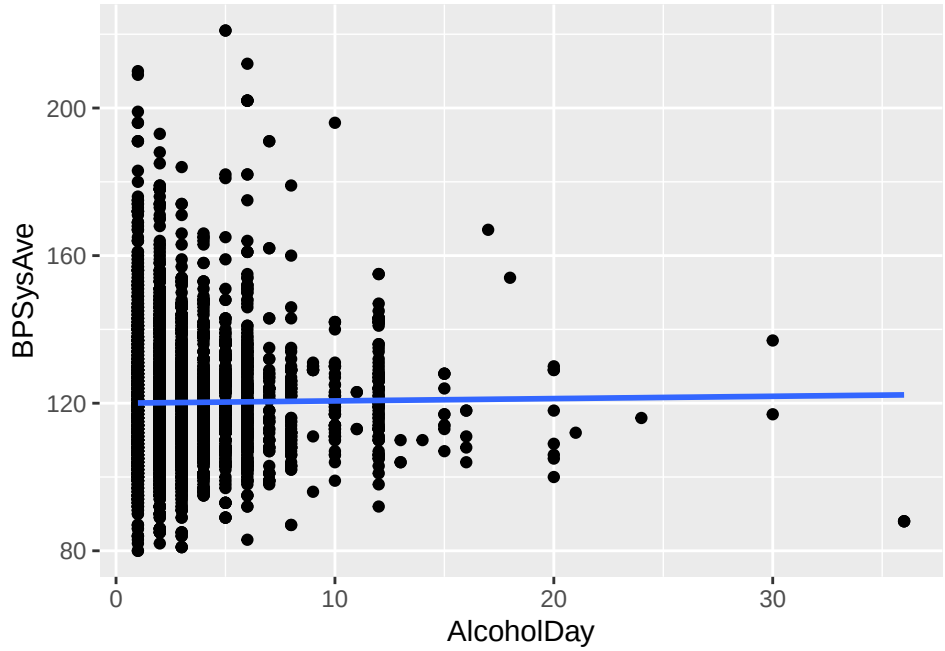


```
 OurData %>%
  lm(Pulse ~ as.factor(HHIncomeMid), data = .) %>%
  tidy()
```

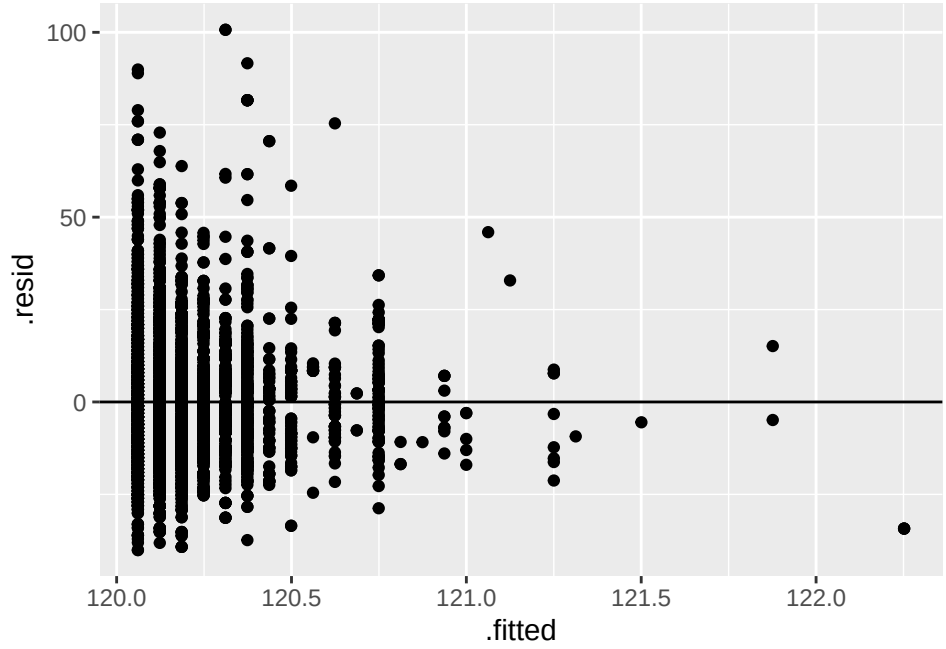
```
## # A tibble: 12 x 5
##    term                          estimate std.error statistic p.value
##    <chr>                            <dbl>     <dbl>     <dbl>   <dbl>
##  1 (Intercept)                     73.7         1.02   72.6     0
##  2 as.factor(HHIncomeMid)7500       1.78        1.33    1.34    0.180
##  3 as.factor(HHIncomeMid)12500      1.33        1.16    1.14    0.254
##  4 as.factor(HHIncomeMid)17500     -0.0500      1.17   -0.0428  0.966
##  5 as.factor(HHIncomeMid)22500      2.31        1.15    2.01    0.0441
##  6 as.factor(HHIncomeMid)30000      0.652       1.10    0.592   0.554
##  7 as.factor(HHIncomeMid)40000      0.591       1.11    0.534   0.594
##  8 as.factor(HHIncomeMid)50000     -1.06        1.12   -0.949   0.343
##  9 as.factor(HHIncomeMid)60000     -1.45        1.14   -1.28    0.202
## 10 as.factor(HHIncomeMid)70000      0.106       1.16    0.0919  0.927
## 11 as.factor(HHIncomeMid)87500      0.0613      1.09    0.0563  0.955
## 12 as.factor(HHIncomeMid)100000    -1.56        1.05   -1.49    0.137
```

```
Alcohol_new <- NHANES %>%
  filter(AlcoholDay <= 40)
```

```
Alcohol_new %>%
  lm(BPSysAve ~ AlcoholDay, data = .) %>%
  ggplot(aes(x=AlcoholDay, y=BPSysAve)) +
  geom_point() +
  geom_smooth(method= "lm", se= FALSE)
```



```
Alcohol_new %>%
  lm(BPSysAve ~ AlcoholDay, data = .) %>%
  augment() %>%
  ggplot(aes(x = .fitted, y = .resid)) +
  geom_point() +
  geom_hline(yintercept = 0)
```

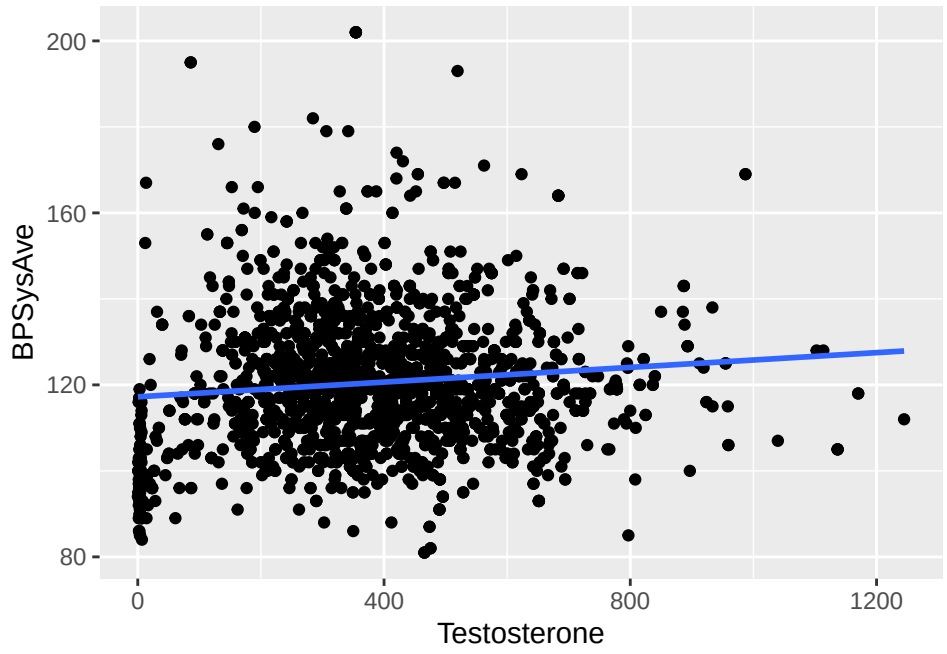



```
 NHANES %>%
  lm(BPSysAve ~ AlcoholDay, data = .) %>%
   tidy()
```

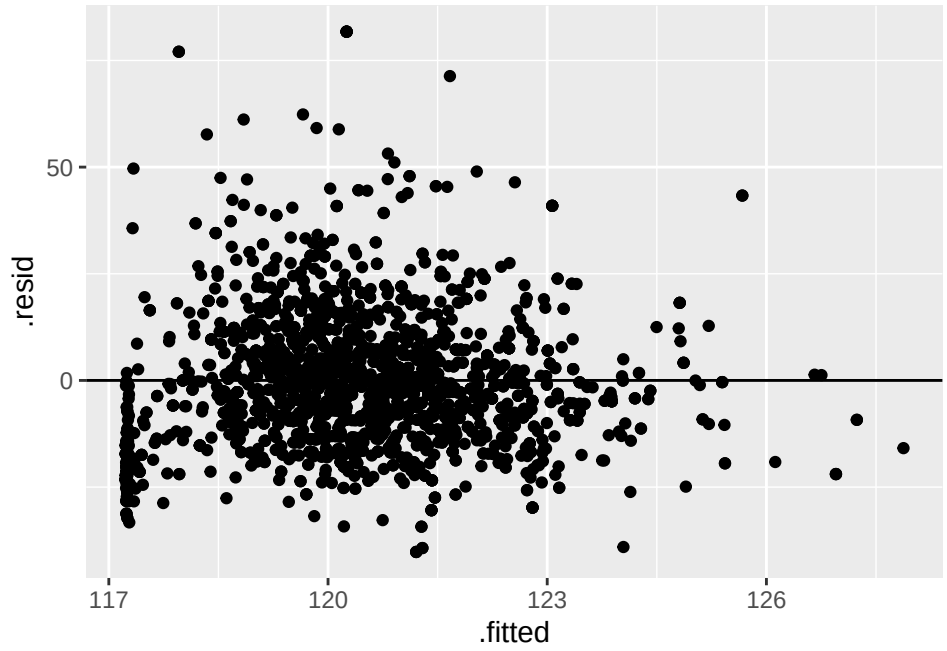
```
## # A tibble: 2 x 5
##   term        estimate std.error statistic p.value
##   <chr>          <dbl>     <dbl>     <dbl>   <dbl>
## 1 (Intercept) 120.        0.319    377.      0
## 2 AlcoholDay   -0.0119    0.0741    -0.161   0.872
```

```
testosterone_new <-NHANES %>%
  filter(Testosterone < 1400 ) %>%
  filter(Gender == "male")
```

```
 testosterone_new %>%
  lm(BPSysAve ~ Testosterone, data = .) %>%
  ggplot(aes(x=Testosterone, y=BPSysAve)) + geom_point() + geom_smooth(method= "lm", se= FALSE)
```




```
testosterone_new %>%
 lm(BPSysAve ~ Testosterone, data = .) %>%
 augment() %>%
 ggplot(aes(x = .fitted, y = .resid)) +
 geom_point() +
 geom_hline(yintercept = 0)
```




```
testosterone_new %>%
 lm(Pulse ~ Testosterone, data = .) %>%
 tidy(conf.int = TRUE, conf.level = 0.95)
```

```
## # A tibble: 2 x 7
##   term         estimate std.error statistic  p.value conf.low conf.high
##   <chr>           <dbl>     <dbl>     <dbl>    <dbl>    <dbl>     <dbl>
## 1 (Intercept)   76.9      0.586      131.   0         75.7      78.0
## 2 Testosterone  -0.0130   0.00137     -9.52 5.08e-21  -0.0157   -0.0103
```

```
testosterone_new %>%
 lm(Pulse ~ Testosterone, data = .) %>%
 glance()
```

```
## # A tibble: 1 x 12
##   r.squared adj.r.squared sigma statistic  p.value    df logLik    AIC    BIC
##       <dbl>         <dbl> <dbl>     <dbl>    <dbl> <dbl>  <dbl>  <dbl>  <dbl>
## 1    0.0438        0.0433  11.9      90.5 5.08e-21     1 -7694. 15394. 15411.
## # ... with 3 more variables: deviance <dbl>, df.residual <int>, nobs <int>
```

Conclusion

Comment on anything of interest that occurred in doing the project. Were the data approximately what you expected or did some of the results surprise you? What other questions would you like to ask about the data?)

Oversampling and NHANES

NHANES "over-samples persons 60 and older, African Americans, Asians, and Hispanics" to create more reliable and representative samples of the population. According to NHANES, "the United States has experienced dramatic growth in the number of older people during this century, the aging population has major implications for health care needs, public policy, and research priorities. NCHS is working with public health agencies to increase the knowledge of the health status of older Americans."

Additonally, figure ___ (histogram of participant race) aligns with the race distribution of the 2010 census data as a result of the over-sampling. While the census data itself may be biased from certain participant's being more likely to respond, it is clear that over-sampling "African Americans, Asians, and Hispanics" helps NHANES better match the racial demographics of their population.