project_eda

```
library(dplyr)
```

```
## Warning: package 'dplyr' was built under R version 3.3.2
```

```
##
## Attaching package: 'dplyr'
```

```
## The following objects are masked from 'package:stats':
##
##     filter, lag
```

```
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```
# lab = read.csv("data/health/labs.csv")
demographics = read.csv("data/health/demographic.csv")
ques = read.csv("data/health/questionnaire.csv")
exam = read.csv("data/health/examination.csv")

# join tables by participant ID
df = inner_join(demographics, ques, by="SEQN")
df = inner_join(df, exam, by="SEQN")
dim(df)
```

```
## [1] 9813 1222
```

```
# subset df_adult to consider only the variables we're interested in
response = "BMXWT"
predictors = c("BMXHT", "RIAGENDR", "RIDAGEYR", "RIDRETH3", "DMDEDUC2", "DMDMARTL", "DMDFMSIZ", "INDFMI
               "ALQ101", "ALQ120Q",
               "CBD070", "CBD120", "CBD130",
               "DBD895", "DBD900", "DBQ197",
               "DPQ020", "DPQ030",
               "PAQ710",
               "SLD010H", "SMQ040")

columns = c(predictors, response)

df = df[names(df) %in% columns]

# rename columns to more intuitive names
df = rename(df, height = BMXHT, gender = RIAGENDR, age = RIDAGEYR, race = RIDRETH3, edu = DMDEDUC2,
            marriage = DMDMARTL, famsize = DMDFMSIZ, famincome = INDFMIN2,
            alcohol12yr = ALQ101, alcoholfrq = ALQ120Q, grocery = CBD070, eatout = CBD120,
            delivery = CBD130, milk = DBQ197, meals_nothome = DBD895, meals_fastfood = DBD900,
            depressed = DPQ020, sleep_trouble = DPQ030, tv_hrs = PAQ710,
            sleep_hr = SLD010H, smoke = SMQ040, weight = BMXWT)

# subset the df to consider only adults aged 18 or above
df_adult = df[df$age > 20,]

df_adult = df_adult[which(df_adult$grocery!=777777 & df_adult$grocery!=999999),]
```

```r
df_adult = df_adult[which(df_adult$eatout!=777777 & df_adult$eatout!=999999),]
df_adult = df_adult[which(df_adult$delivery!=777777 & df_adult$delivery!=999999),]

df_adult = df_adult[which(df_adult$alcoholfrq != 999),]

df_adult = df_adult[which(df_adult$meals_nothome != 5555 & df_adult$meals_nothome != 7777 & df_adult$mea

df_adult = df_adult[which(df_adult$meals_fastfood != 5555 & df_adult$meals_fastfood != 7777 & df_adult$m

df_adult$tv_hrs[which(df_adult$tv_hrs == 0)] = 1
df_adult$tv_hrs[which(df_adult$tv_hrs == 8)] = 0
df_adult = df_adult[which(df_adult$tv_hrs != 77 & df_adult$tv_hrs != 99),]

df_adult = df_adult[which(df_adult$sleep_hr != 99),]

df_adult$smoke[which(is.na(df_adult$smoke))] = "missing"

# drop observations where number of missing value in certain columns is < 100
drop_obs = c("famincome", "grocery", "eatout", "delivery",
             "sleep_hr","depressed", "sleep_trouble", "height", "weight")

for (feature in drop_obs){
  df_adult = df_adult[!is.na(df_adult[feature]),]
}

categorical_features = c("gender", "race", "edu", "marriage",
                         "famincome", "alcohol12yr", "milk", "depressed",
                         "sleep_trouble", "smoke", "tv_hrs")

numeric_features = c("age", "famsize", "alcoholfrq", "grocery", "eatout",
                     "delivery", "meals_nothome", "meals_fastfood", "sleep_hr")

# convert categorical variables into factors
df_adult[categorical_features] = lapply(df_adult[categorical_features], factor)

apply(df_adult, 2, function(x) sum(is.na(x))) # check how many missing data
```

```
##         gender            age           race            edu       marriage
##              0              0              0              0              0
##       famsize      famincome    alcohol12yr     alcoholfrq        grocery
##              0              0              0              0              0
##         eatout       delivery           milk  meals_nothome meals_fastfood
##              0              0              0              0              0
##      depressed  sleep_trouble         tv_hrs       sleep_hr          smoke
##              0              0              0              0              0
##         weight         height
##              0              0
```

```r
sapply(df_adult, class) # check data classes
```

```
##         gender            age           race            edu       marriage
##       "factor"      "integer"       "factor"       "factor"       "factor"
##       famsize      famincome    alcohol12yr     alcoholfrq        grocery
##      "integer"       "factor"       "factor"      "integer"      "integer"
```

```
##         eatout       delivery           milk  meals_nothome meals_fastfood
##      "integer"      "integer"       "factor"      "integer"      "integer"
##      depressed  sleep_trouble         tv_hrs       sleep_hr          smoke
##       "factor"       "factor"       "factor"      "integer"       "factor"
##         weight         height
##      "numeric"      "numeric"
```

Exploratory Data Analysis

Response Variable (BMI)

```
library(ggplot2)
require(gridExtra)
```

```
## Loading required package: gridExtra
```

```
##
## Attaching package: 'gridExtra'
```

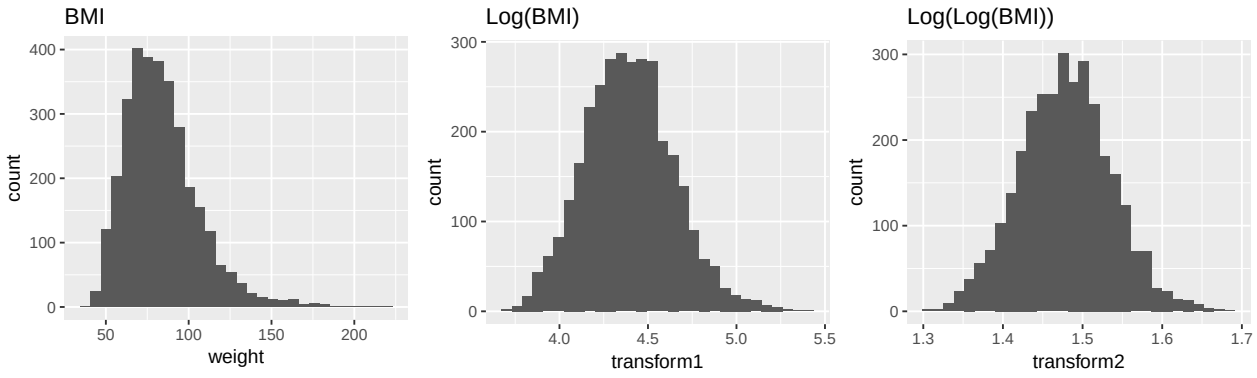
```
## The following object is masked from 'package:dplyr':
##
##     combine
```

```
transform1 = log(df_adult$weight)
transform2 = log(log(df_adult$weight))

# response variable distribution
plot1 = ggplot(df_adult, aes(weight)) +
  geom_histogram() +
  ggtitle("BMI")
plot2 = ggplot(df_adult, aes(transform1)) +
  geom_histogram() +
  ggtitle("Log(BMI)")
plot3 = ggplot(df_adult, aes(transform2)) +
  geom_histogram() +
  ggtitle("Log(Log(BMI))")
grid.arrange(plot1, plot2, plot3, ncol=3)
```

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```

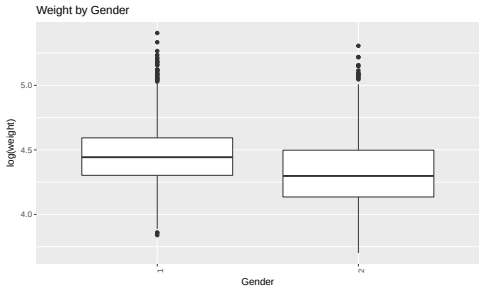


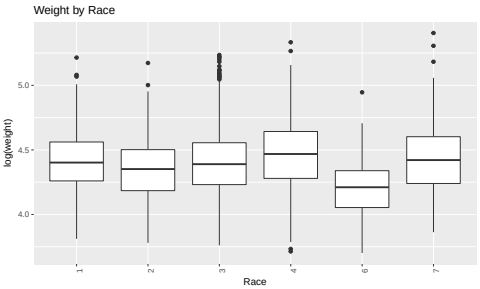
```
df_adult$log.weight = log(df_adult$weight)
```

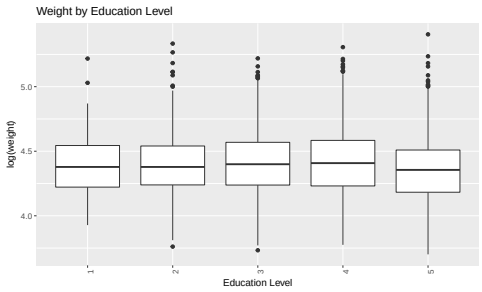
Predictor Variables

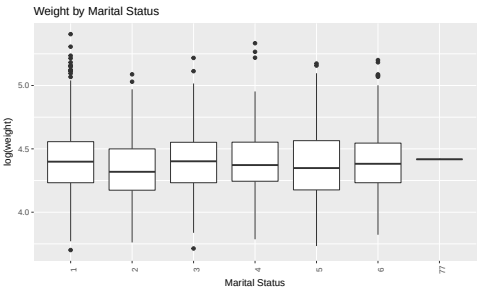
Categorical Variables

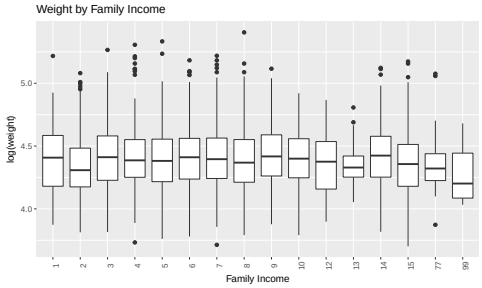
```
plot1 = ggplot(df_adult, aes(x=gender, y = log.weight)) + geom_boxplot() +
  theme(axis.text.x = element_text(angle=90)) +
  labs(x="Gender", y="log(weight)") +
  ggtitle("Weight by Gender")
plot2 = ggplot(df_adult, aes(x=race, y = log.weight)) + geom_boxplot() +
  theme(axis.text.x = element_text(angle=90)) +
  labs(x="Race", y="log(weight)") +
  ggtitle("Weight by Race")
plot3 = ggplot(df_adult, aes(x=edu, y = log.weight)) + geom_boxplot() +
  theme(axis.text.x = element_text(angle=90)) +
  labs(x="Education Level", y="log(weight)") +
  ggtitle("Weight by Education Level")
plot4 = ggplot(df_adult, aes(x=marriage, y = log.weight)) + geom_boxplot() +
  theme(axis.text.x = element_text(angle=90)) +
  labs(x="Marital Status", y="log(weight)") +
  ggtitle("Weight by Marital Status")
plot5 = ggplot(df_adult, aes(x=famincome, y = log.weight)) + geom_boxplot() +
  theme(axis.text.x = element_text(angle=90)) +
  labs(x="Family Income", y="log(weight)") +
  ggtitle("Weight by Family Income")
plot6 = ggplot(df_adult, aes(x=alcohol12yr, y = log.weight)) + geom_boxplot() +
  theme(axis.text.x = element_text(angle=90)) +
  labs(x="Alcohol Use", y="log(weight)") +
  ggtitle("Weight by Alcohol Use")
plot7 = ggplot(df_adult, aes(x=milk, y = log.weight)) + geom_boxplot() +
  theme(axis.text.x = element_text(angle=90)) +
  labs(x="Milk Consumption", y="log(weight)") +
  ggtitle("Weight by Milk Consumption")
plot8 = ggplot(df_adult, aes(x=depressed, y = log.weight)) + geom_boxplot() +
  theme(axis.text.x = element_text(angle=90)) +
  labs(x="Depressed", y="log(weight)") +
  ggtitle("Weight by Despressed")
plot9 = ggplot(df_adult, aes(x=sleep_trouble, y = log.weight)) + geom_boxplot() +
  theme(axis.text.x = element_text(angle=90)) +
  labs(x="Alcohol Use", y="log(weight)") +
  ggtitle("Weight by Sleep Trouble")
plot10 = ggplot(df_adult, aes(x=smoke, y = log.weight)) + geom_boxplot() +
  theme(axis.text.x = element_text(angle=90)) +
  labs(x="Smoke", y="log(weight)") +
  ggtitle("Weight by Smoke")
plot11 = ggplot(df_adult, aes(x=tv_hrs, y = log.weight)) + geom_boxplot() +
  theme(axis.text.x = element_text(angle=90)) +
  labs(x="TV Consumption", y="log(weight)") +
  ggtitle("Weight by TV Consumption")
grid.arrange(plot1, plot2, plot3, plot4, plot5, plot6, plot7, plot8, plot9, plot10, plot11, ncol=2)
```

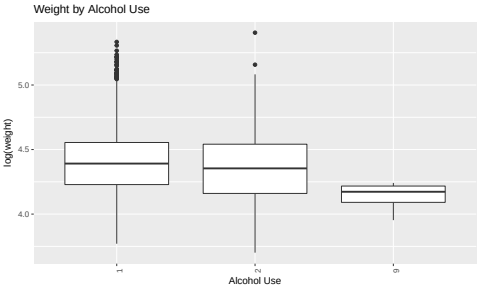

Weight by Gender
log(weight)
5.0
4.5
4.0
1
2
Gender

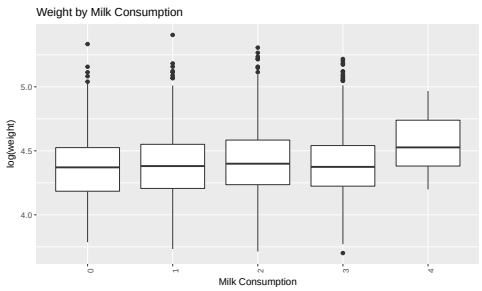

Weight by Race
log(weight)
5.0
4.5
4.0
1
2
3
4
6
7
Race

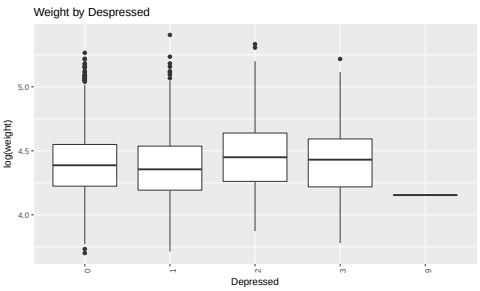

Weight by Education Level
log(weight)
5.0
4.5
4.0
1
2
3
4
5
Education Level

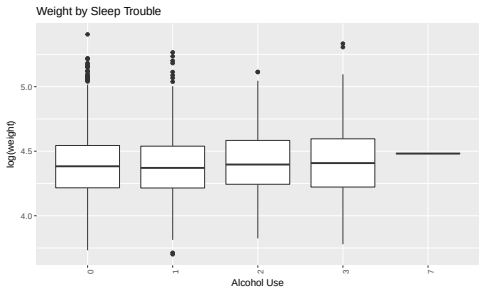

Weight by Marital Status
log(weight)
5.0
4.5
4.0
1
2
3
4
5
6
77
Marital Status

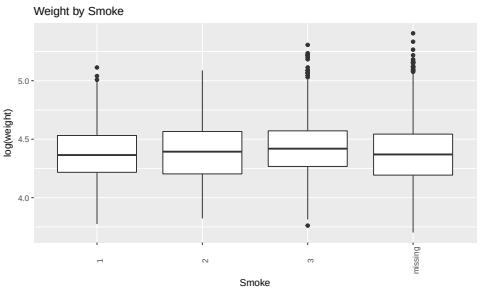

Weight by Family Income
log(weight)
5.0
4.5
4.0
1
2
3
4
5
6
7
8
9
10
12
13
14
15
77
99
Family Income

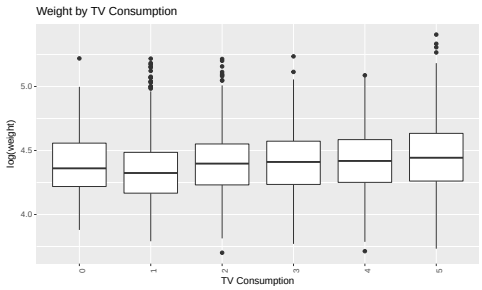

Weight by Alcohol Use
log(weight)
5.0
4.5
4.0
1
9
Alcohol Use


Weight by Milk Consumption
log(weight)
5.0
4.5
4.0
0
1
2
3
4
Milk Consumption


Weight by Despressed
log(weight)
5.0
4.5
4.0
0
1
2
3
9
Depressed


Weight by Sleep Trouble
log(weight)
5.0
4.5
4.0
0
1
2
3
7
Alcohol Use


Weight by Smoke
log(weight)
5.0
4.5
4.0
1
2
3
missing
Smoke


Weight by TV Consumption
log(weight)
5.0
4.5
4.0
0
1
2
3
4
5
TV Consumption

Numeric Variables

Distribtuion of numeric variables

```
# numeric predictor variable distributions
plot1 = ggplot(df_adult, aes(age)) + geom_histogram() +
  ggtitle("Age")
plot2 = ggplot(df_adult, aes(height)) + geom_histogram() +
  ggtitle("Height")
plot3 = ggplot(df_adult, aes(famsize)) + geom_histogram() +
  ggtitle("Family Size")
plot4 = ggplot(df_adult, aes(alcoholfrq)) + geom_histogram() +
  ggtitle("Frequency of Alcohol Consumption")
plot5 = ggplot(df_adult, aes(grocery)) + geom_histogram() +
  ggtitle("Money Spent on Grocery")
plot6 = ggplot(df_adult, aes(eatout)) + geom_histogram() +
  ggtitle("Money Spent Eating Out")
plot7 = ggplot(df_adult, aes(delivery)) + geom_histogram() +
  ggtitle("Money Spent on Delivered Food")
plot8 = ggplot(df_adult, aes(meals_nothome)) + geom_histogram() +
  ggtitle("Number of Meals Not Home Prepared")
plot9 = ggplot(df_adult, aes(meals_fastfood)) + geom_histogram() +
  ggtitle("Number of Fast Food Meals")
plot10 = ggplot(df_adult, aes(sleep_hr)) + geom_histogram() +
  ggtitle("Hours of Sleep")
grid.arrange(plot1, plot2, plot3, plot4, plot5, plot6, plot7, plot8, plot9, plot10, ncol=2)
```

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
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## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```
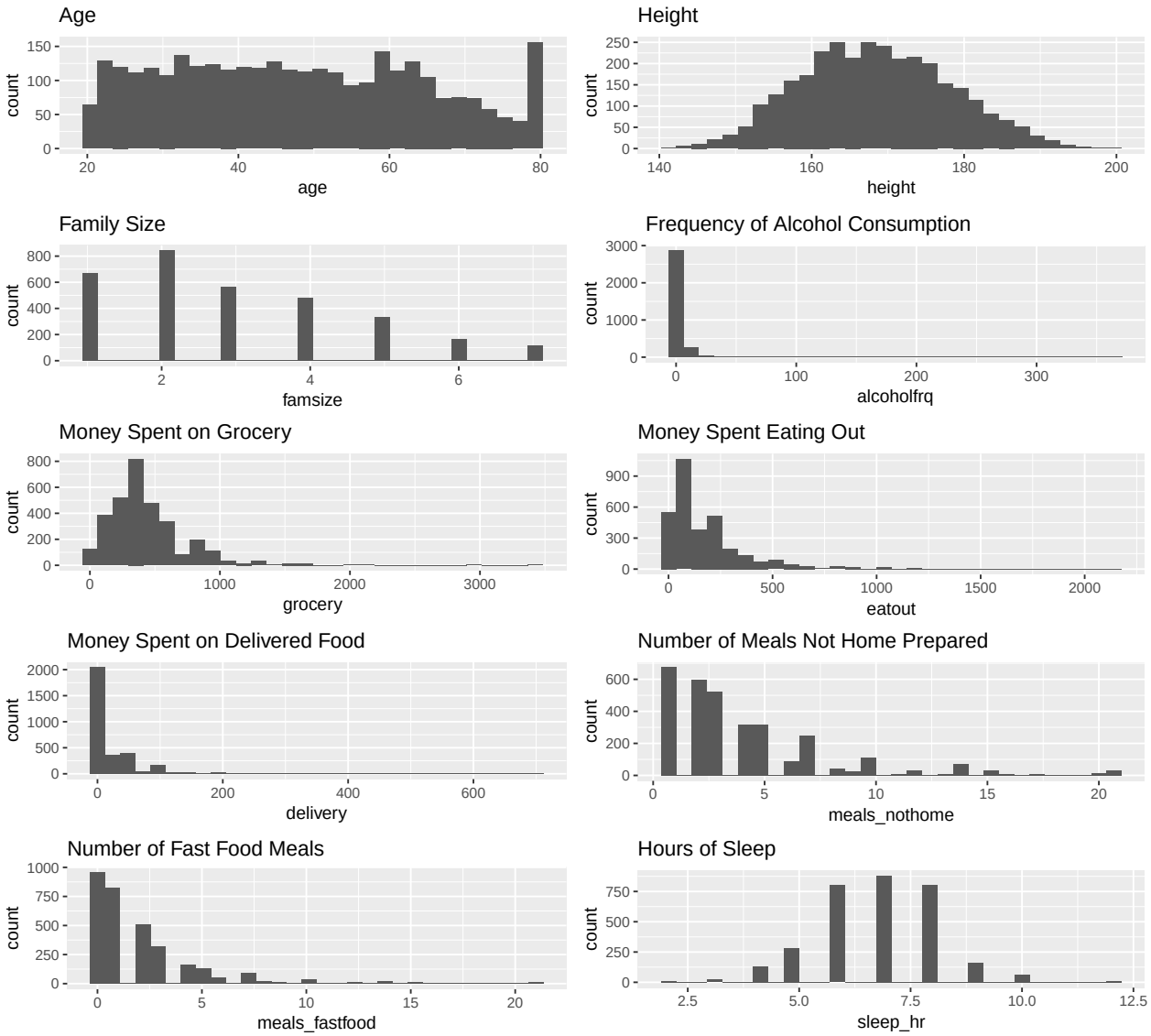
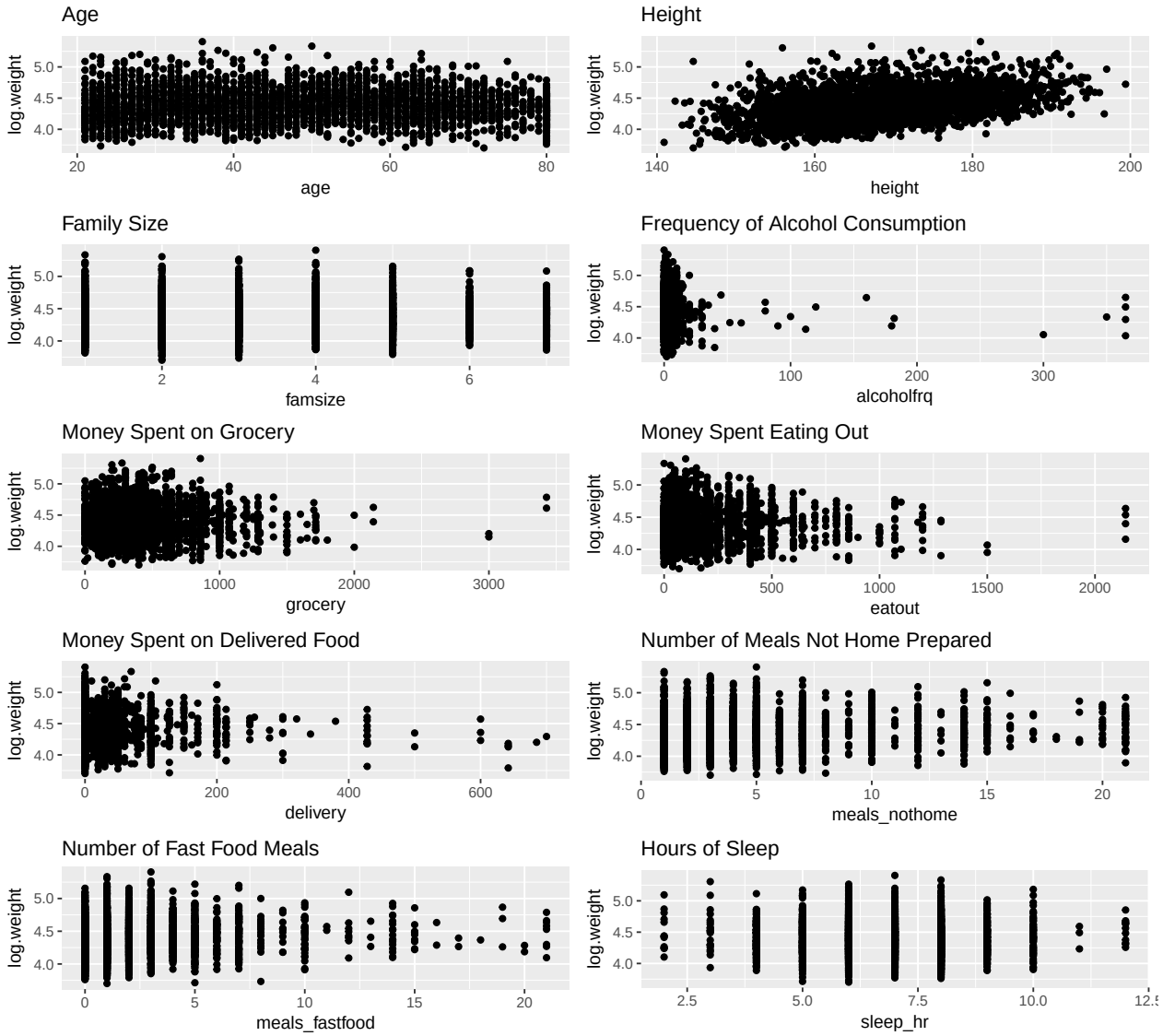



Response vs. numeric distribution

```
# df_adult$log.alcoholfrq = log(df_adult$alcoholfrq + 1)
# df_adult$log.grocery = log(df_adult$grocery + 1)
# df_adult$log.eatout = log(df_adult$eatout + 1)
# df_adult$log.delivery = log(df_adult$delivery + 1)

# numeric predictor variable distributions
plot1 = ggplot(df_adult, aes(x=age, y=log.weight)) + geom_point() +
  ggtitle("Age")
plot2 = ggplot(df_adult, aes(x=height, y=log.weight)) + geom_point() +
  ggtitle("Height")
plot3 = ggplot(df_adult, aes(x=famsize, y=log.weight)) + geom_point() +
  ggtitle("Family Size")
plot4 = ggplot(df_adult, aes(x=alcoholfrq, y=log.weight)) + geom_point() +
  ggtitle("Frequency of Alcohol Consumption")
plot5 = ggplot(df_adult, aes(x=grocery, y=log.weight)) + geom_point() +
  ggtitle("Money Spent on Grocery")
```

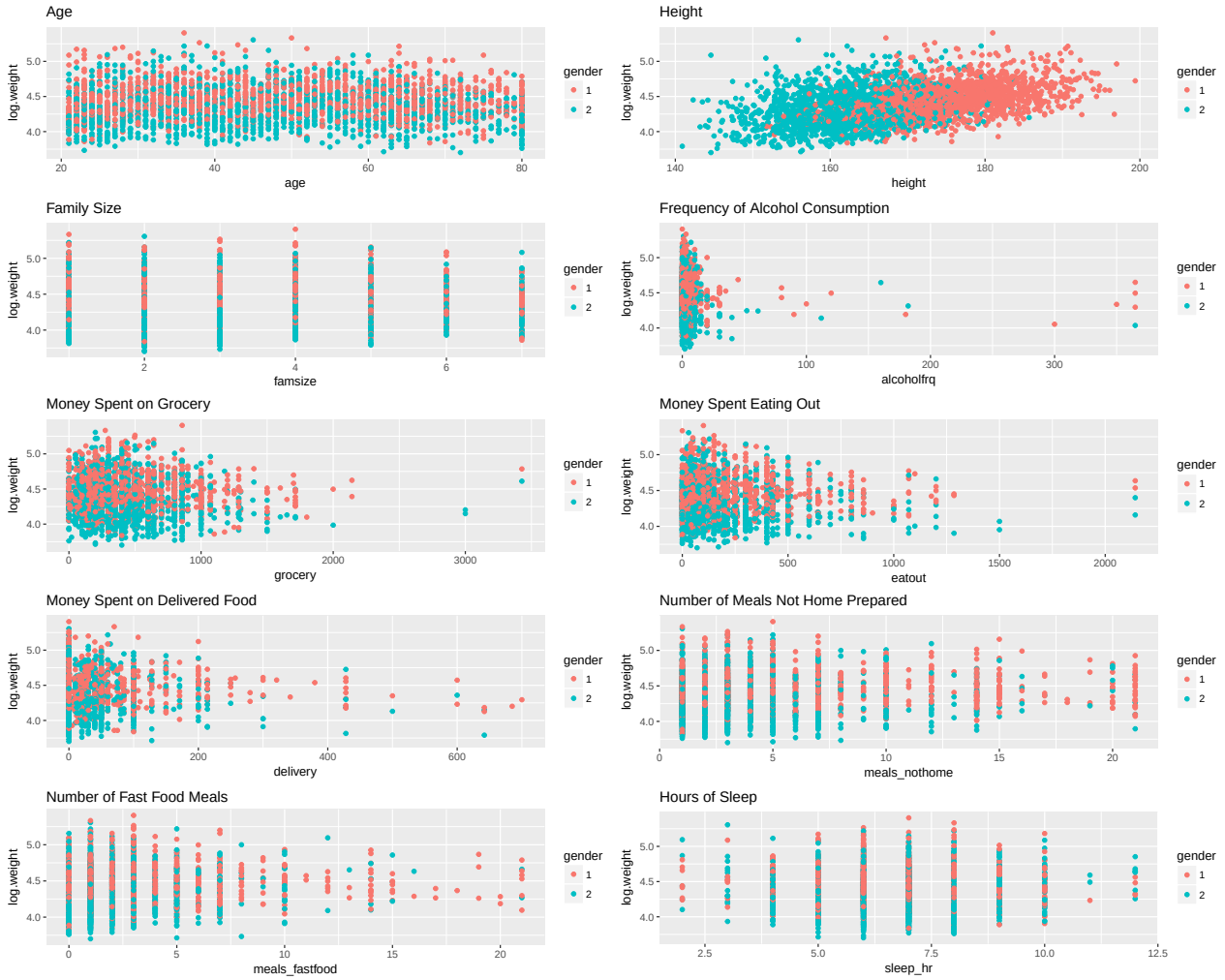
```
plot6 =ggplot(df_adult, aes(x=eatout, y=log.weight)) + geom_point() +
  ggtitle("Money Spent Eating Out")
plot7 = ggplot(df_adult, aes(x=delivery, y=log.weight)) + geom_point() +
  ggtitle("Money Spent on Delivered Food")
plot8 =ggplot(df_adult, aes(x=meals_nothome, y=log.weight)) + geom_point() +
  ggtitle("Number of Meals Not Home Prepared")
plot9 = ggplot(df_adult, aes(x=meals_fastfood, y=log.weight)) + geom_point() +
  ggtitle("Number of Fast Food Meals")
plot10 = ggplot(df_adult, aes(x=sleep_hr, y=log.weight)) + geom_point() +
  ggtitle("Hours of Sleep")
grid.arrange(plot1, plot2, plot3, plot4, plot5, plot6, plot7, plot8, plot9, plot10, ncol=2)
```



color by some factor

```
# numeric predictor variable distributions
plot1 = ggplot(df_adult, aes(x=age, y=log.weight, colour=gender)) + geom_point() +
  ggtitle("Age")
plot2 = ggplot(df_adult, aes(x=height, y=log.weight, colour=gender)) + geom_point() +
```

```
  ggtitle("Height")
plot3 = ggplot(df_adult, aes(x=famsize, y=log.weight, colour=gender)) + geom_point() +
  ggtitle("Family Size")
plot4 = ggplot(df_adult, aes(x=alcoholfrq, y=log.weight, colour=gender)) + geom_point() +
  ggtitle("Frequency of Alcohol Consumption")
plot5 = ggplot(df_adult, aes(x=grocery, y=log.weight, colour=gender)) + geom_point() +
  ggtitle("Money Spent on Grocery")
plot6 =ggplot(df_adult, aes(x=eatout, y=log.weight, colour=gender)) + geom_point() +
  ggtitle("Money Spent Eating Out")
plot7 = ggplot(df_adult, aes(x=delivery, y=log.weight, colour=gender)) + geom_point() +
  ggtitle("Money Spent on Delivered Food")
plot8 =ggplot(df_adult, aes(x=meals_nothome, y=log.weight, colour=gender)) + geom_point() +
  ggtitle("Number of Meals Not Home Prepared")
plot9 = ggplot(df_adult, aes(x=meals_fastfood, y=log.weight, colour=gender)) + geom_point() +
  ggtitle("Number of Fast Food Meals")
plot10 = ggplot(df_adult, aes(x=sleep_hr, y=log.weight, colour=gender)) + geom_point() +
  ggtitle("Hours of Sleep")
grid.arrange(plot1, plot2, plot3, plot4, plot5, plot6, plot7, plot8, plot9, plot10, ncol=2)
```



parallel corrd plot to figure out if interaction may be helpful

```r
# library(MASS)
# library(RColorBrewer)
# k <- adjustcolor(brewer.pal(5, "Set2")[df_adult$sleep_trouble], alpha=.6)
# predictor = c("sleep_hr", "age", "log.delivery", "meals_nothome", "meals_fastfood")
# parcoord(df_adult[,predictor], col=k)
```