Final Project Step1

Basava, Madhuri

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Introduction

Diabetes is one of the leading causes of death worldwide and especially in the USA. Nowadays more people are getting affected by diabetes. This project is to analyze different factors affecting diabetes and based on the results let people know how to prevent diabetes by altering the affecting factors.I feel that health is more than anything in the world, so this project will be useful for many people.

Below are some of the research questions that are relevant

1) How can we reduce diabetes cases in the future?
2) What are the factors affecting diabetes?
3) How much Physical activity in a certain period is needed to reduce diabetes cases?
4) Is smoking, a direct or indirect cause of diabetes?
5) How much BMI value range should a person have to reduce the possibility of diabetes?
6) Does High Blood Pressure, a reason for diabetes?
7) Are Males or Females more prone to diabetes?
8) What age people are getting affected by diabetes more?
9) Is a person's heart attack/stroke has to be more careful?
10) Will high cholesterol lead to Diabetes?
11) Will heavy alcohol consumption lead to Diabetes?
12) Is diabetes dependent on physical, general, or mental health?

Approach

- Clean the data: Firstly, I will remove the NA values from the dataset.
- Perform some transformations to tidy up the data.
- Then, Analyse the data and visualize it in the form of different graphs and charts to figure out
- what are the factors which are affecting diabetes?
- plot the graphs with Diabetes on Y axis and physical activity on X-axis and analyze them.
- plot the graphs with Diabetes on Y axis and smoking on X-axis
- plot the graphs with Diabetes on Y axis and BMI on X-axis
- plot the graphs with Diabetes on Y axis and HighBP on X-axis
- plot the graphs with Diabetes on Y axis and Sex on X-axis
- plot the graphs with Diabetes on Y axis and Age on X-axis
- plot the graphs with Diabetes on Y axis and HeartDiseaseorAttack on X-axis
- plot the graphs with Diabetes on Y axis and HighChol on X-axis
- plot the graphs with Diabetes on Y axis and HvyAlcoholConsump on X-axis
- plot the graphs with Diabetes and physical, general, or mental health
- Finally provide useful analysis for people who can change their lifestyle to reduce Diabetes cases.

How your approach addresses (fully or partially) the problem.

The analysis gives us the idea of which factors are more likely to cause diabetes and share the results with everyone, so that people will change their lifestyles accordingly to reduce diabetes problems in the future.

Data (Minimum of 3 Datasets - but no requirement on number of fields or rows)

3 data sets chosen for this project are from Kaggle site.

- diabetes_012_health_indicators_BRFSS2015.xlsx
- diabetes_binary_5050split_health_indicators_BRFSS2015.xlsx
- diabetes_binary_health_indicators_BRFSS2015.xlsx

The purpose of the data is to analyze the factors/predictors affecting Diabetes. The data was collected from the year 2015. The original data has 22 columns in each data set many thousands of rows/records. There were no missing data. I took 50 rows/records from each dataset and combined them into one dataset by binding the rows which now have 150 rows/records.

Required Packages

The important packages needed for this project are

- realxl – to read the excel data files.
- dplyr – to analyze/transform the data using GroupBy, Summarize, Mutate, Filter, Select, and Arrange
- tidyr – to tidy data to make the data more consistent
- ggplot2 – for visualizing the different factors affecting diabetes.
- pheatmap – to draw a heatmap of our correlation table
- psych – to derive descriptive statistics for a data set

Plots and Table Needs

Below are the Plots and tables used in this project:

- histograms
- bar graphs
- heatmaps
- scatterplots
- boxplots

Questions for future steps

I do not know how to graph using heatmaps to visualize all the predictors for data analysis.

Diabetes Indicator Project

Set the working directory to the root of your DSC 520 directory

```
setwd("C:/MadhuriDocs/MSInDataScience/DSC520RCourse3/Week8/project_data/Health")
getwd()
```

```
## [1] "C:/MadhuriDocs/MSInDataScience/DSC520RCourse3/Week8/project_data/Health"
```

Load the dataset 1

```
library(readxl)
excel_sheets('diabetes_indicator.xlsx')
```

```
## [1] "Sheet1"
```

```
diabetes_indicator_df <- read_excel('diabetes_indicator.xlsx',  sheet='Sheet1')
diabetes_indicator_df
```

```
## # A tibble: 50 x 22
##    Diabetes_~1 HighBP HighC~2 CholC~3   BMI Smoker Stroke Heart~4 PhysA~5 Fruits
##          <dbl>  <dbl>   <dbl>   <dbl> <dbl>  <dbl>  <dbl>   <dbl>   <dbl>  <dbl>
##  1           0      1       1       1    40      1      0       0       0      0
##  2           0      0       0       0    25      1      0       0       1      0
##  3           0      1       1       1    28      0      0       0       0      1
##  4           0      1       0       1    27      0      0       0       1      1
##  5           0      1       1       1    24      0      0       0       1      1
##  6           0      1       1       1    25      1      0       0       1      1
##  7           0      1       0       1    30      1      0       0       0      0
##  8           0      1       1       1    25      1      0       0       1      0
##  9           2      1       1       1    30      1      0       1       0      1
## 10           0      0       0       1    24      0      0       0       0      0
## # ... with 40 more rows, 12 more variables: Veggies <dbl>,
## #   HvyAlcoholConsump <dbl>, AnyHealthcare <dbl>, NoDocbcCost <dbl>,
## #   GenHlth <dbl>, MentHlth <dbl>, PhysHlth <dbl>, DiffWalk <dbl>, Sex <dbl>,
## #   Age <dbl>, Education <dbl>, Income <dbl>, and abbreviated variable names
## #   1: Diabetes_012, 2: HighChol, 3: CholCheck, 4: HeartDiseaseorAttack,
## #   5: PhysActivity
```

#rename the “Diabetes_012” column to “Diabetes” column to match columns with other dataframes

```
names(diabetes_indicator_df)[names(diabetes_indicator_df) == "Diabetes_012"] <- "Diabetes"
diabetes_indicator_df
```

```
## # A tibble: 50 x 22
##    Diabetes HighBP HighChol CholCheck   BMI Smoker Stroke Heart~1 PhysA~2 Fruits
##       <dbl>  <dbl>    <dbl>     <dbl> <dbl>  <dbl>  <dbl>   <dbl>   <dbl>  <dbl>
##  1        0      1        1         1    40      1      0       0       0      0
```

```
##  2        0      0        0         0    25      1      0       0       1      0
##  3        0      1        1         1    28      0      0       0       0      1
##  4        0      1        0         1    27      0      0       0       1      1
##  5        0      1        1         1    24      0      0       0       1      1
##  6        0      1        1         1    25      1      0       0       1      1
##  7        0      1        0         1    30      1      0       0       0      0
##  8        0      1        1         1    25      1      0       0       1      0
##  9        2      1        1         1    30      1      0       1       0      1
## 10        0      0        0         1    24      0      0       0       0      0
## # ... with 40 more rows, 12 more variables: Veggies <dbl>,
## #   HvyAlcoholConsump <dbl>, AnyHealthcare <dbl>, NoDocbcCost <dbl>,
## #   GenHlth <dbl>, MentHlth <dbl>, PhysHlth <dbl>, DiffWalk <dbl>, Sex <dbl>,
## #   Age <dbl>, Education <dbl>, Income <dbl>, and abbreviated variable names
## #   1: HeartDiseaseorAttack, 2: PhysActivity
```

```
summary(diabetes_indicator_df)
```

```
##     Diabetes        HighBP        HighChol      CholCheck         BMI
##  Min.   :0.00   Min.   :0.00   Min.   :0.00   Min.   :0.00   Min.   :21.00
##  1st Qu.:0.00   1st Qu.:0.00   1st Qu.:0.00   1st Qu.:1.00   1st Qu.:24.25
##  Median :0.00   Median :1.00   Median :1.00   Median :1.00   Median :27.50
##  Mean   :0.48   Mean   :0.62   Mean   :0.54   Mean   :0.96   Mean   :28.06
##  3rd Qu.:0.00   3rd Qu.:1.00   3rd Qu.:1.00   3rd Qu.:1.00   3rd Qu.:31.00
##  Max.   :2.00   Max.   :1.00   Max.   :1.00   Max.   :1.00   Max.   :40.00
##      Smoker         Stroke    HeartDiseaseorAttack  PhysActivity      Fruits
##  Min.   :0.0   Min.   :0.0   Min.   :0.0          Min.   :0.00   Min.   :0.00
##  1st Qu.:0.0   1st Qu.:0.0   1st Qu.:0.0          1st Qu.:0.00   1st Qu.:0.00
##  Median :1.0   Median :0.0   Median :0.0          Median :1.00   Median :1.00
##  Mean   :0.6   Mean   :0.1   Mean   :0.1          Mean   :0.52   Mean   :0.58
##  3rd Qu.:1.0   3rd Qu.:0.0   3rd Qu.:0.0          3rd Qu.:1.00   3rd Qu.:1.00
##  Max.   :1.0   Max.   :1.0   Max.   :1.0          Max.   :1.00   Max.   :1.00
##     Veggies     HvyAlcoholConsump AnyHealthcare  NoDocbcCost      GenHlth
##  Min.   :0.00   Min.   :0.00      Min.   :0.0   Min.   :0.00   Min.   :1.00
##  1st Qu.:1.00   1st Qu.:0.00      1st Qu.:1.0   1st Qu.:0.00   1st Qu.:2.00
##  Median :1.00   Median :0.00      Median :1.0   Median :0.00   Median :3.00
##  Mean   :0.76   Mean   :0.02      Mean   :0.9   Mean   :0.08   Mean   :2.82
##  3rd Qu.:1.00   3rd Qu.:0.00      3rd Qu.:1.0   3rd Qu.:0.00   3rd Qu.:3.00
##  Max.   :1.00   Max.   :1.00      Max.   :1.0   Max.   :1.00   Max.   :5.00
##     MentHlth       PhysHlth        DiffWalk         Sex            Age
##  Min.   : 0.0   Min.   : 0.00   Min.   :0.00   Min.   :0.00   Min.   : 2.00
##  1st Qu.: 0.0   1st Qu.: 0.00   1st Qu.:0.00   1st Qu.:0.00   1st Qu.: 7.00
##  Median : 0.0   Median : 0.00   Median :0.00   Median :0.00   Median : 9.00
##  Mean   : 6.5   Mean   : 6.80   Mean   :0.34   Mean   :0.32   Mean   : 8.94
##  3rd Qu.: 9.0   3rd Qu.: 9.25   3rd Qu.:1.00   3rd Qu.:1.00   3rd Qu.:11.00
##  Max.   :30.0   Max.   :30.00   Max.   :1.00   Max.   :1.00   Max.   :13.00
##    Education       Income
##  Min.   :2.0   Min.   :1.00
##  1st Qu.:4.0   1st Qu.:3.00
##  Median :5.0   Median :4.00
##  Mean   :4.7   Mean   :4.86
##  3rd Qu.:6.0   3rd Qu.:7.00
##  Max.   :6.0   Max.   :8.00
```

```r
library("psych")
describe(diabetes_indicator_df)
```

```
##                        vars  n  mean    sd median trimmed  mad min max range
## Diabetes                  1 50  0.48  0.86    0.0    0.35 0.00   0   2     2
## HighBP                    2 50  0.62  0.49    1.0    0.65 0.00   0   1     1
## HighChol                  3 50  0.54  0.50    1.0    0.55 0.00   0   1     1
## CholCheck                 4 50  0.96  0.20    1.0    1.00 0.00   0   1     1
## BMI                       5 50 28.06  4.65   27.5   27.70 5.19  21  40    19
## Smoker                    6 50  0.60  0.49    1.0    0.62 0.00   0   1     1
## Stroke                    7 50  0.10  0.30    0.0    0.00 0.00   0   1     1
## HeartDiseaseorAttack      8 50  0.10  0.30    0.0    0.00 0.00   0   1     1
## PhysActivity              9 50  0.52  0.50    1.0    0.52 0.00   0   1     1
## Fruits                   10 50  0.58  0.50    1.0    0.60 0.00   0   1     1
## Veggies                  11 50  0.76  0.43    1.0    0.82 0.00   0   1     1
## HvyAlcoholConsump        12 50  0.02  0.14    0.0    0.00 0.00   0   1     1
## AnyHealthcare            13 50  0.90  0.30    1.0    1.00 0.00   0   1     1
## NoDocbcCost              14 50  0.08  0.27    0.0    0.00 0.00   0   1     1
## GenHlth                  15 50  2.82  1.16    3.0    2.78 1.48   1   5     4
## MentHlth                 16 50  6.50 10.63    0.0    4.38 0.00   0  30    30
## PhysHlth                 17 50  6.80 11.12    0.0    4.75 0.00   0  30    30
## DiffWalk                 18 50  0.34  0.48    0.0    0.30 0.00   0   1     1
## Sex                      19 50  0.32  0.47    0.0    0.28 0.00   0   1     1
## Age                      20 50  8.94  2.78    9.0    9.10 2.97   2  13    11
## Education                21 50  4.70  1.11    5.0    4.80 1.48   2   6     4
## Income                   22 50  4.86  2.35    4.0    4.92 2.97   1   8     7
##                         skew kurtosis   se
## Diabetes                1.18    -0.62 0.12
## HighBP                 -0.48    -1.80 0.07
## HighChol               -0.16    -2.01 0.07
## CholCheck              -4.55    19.13 0.03
## BMI                     0.60    -0.42 0.66
## Smoker                 -0.40    -1.88 0.07
## Stroke                  2.59     4.79 0.04
## HeartDiseaseorAttack    2.59     4.79 0.04
## PhysActivity           -0.08    -2.03 0.07
## Fruits                 -0.31    -1.94 0.07
## Veggies                -1.18    -0.62 0.06
## HvyAlcoholConsump       6.65    43.12 0.02
## AnyHealthcare          -2.59     4.79 0.04
## NoDocbcCost             3.00     7.17 0.04
## GenHlth                 0.42    -0.64 0.16
## MentHlth                1.36     0.24 1.50
## PhysHlth                1.32     0.06 1.57
## DiffWalk                0.66    -1.60 0.07
## Sex                     0.75    -1.47 0.07
## Age                    -0.46    -0.55 0.39
## Education              -0.45    -0.55 0.16
## Income                 -0.01    -1.41 0.33
```

Load the dataset 2

```
excel_sheets('diabetes_indicator.xlsx')
```

```
## [1] "Sheet1"
```

```
diabetes_indicator_5050split_df <- read_excel('DiabetesIndicator_5050split.xlsx',  sheet='Sheet1')
diabetes_indicator_5050split_df
```

```
## # A tibble: 50 x 22
##    Diabetes_~1 HighBP HighC~2 CholC~3   BMI Smoker Stroke Heart~4 PhysA~5 Fruits
##          <dbl>  <dbl>   <dbl>   <dbl> <dbl>  <dbl>  <dbl>   <dbl>   <dbl>  <dbl>
##  1           0      1       0       1    26      0      0       0       1      0
##  2           0      1       1       1    26      1      1       0       0      1
##  3           0      0       0       1    26      0      0       0       1      1
##  4           0      1       1       1    28      1      0       0       1      1
##  5           0      0       0       1    29      1      0       0       1      1
##  6           0      0       0       1    18      0      0       0       1      1
##  7           0      0       1       1    26      1      0       0       1      1
##  8           0      0       0       1    31      1      0       0       0      1
##  9           0      0       0       1    32      0      0       0       1      1
## 10           0      0       0       1    27      1      0       0       0      1
## # ... with 40 more rows, 12 more variables: Veggies <dbl>,
## #   HvyAlcoholConsump <dbl>, AnyHealthcare <dbl>, NoDocbcCost <dbl>,
## #   GenHlth <dbl>, MentHlth <dbl>, PhysHlth <dbl>, DiffWalk <dbl>, Sex <dbl>,
## #   Age <dbl>, Education <dbl>, Income <dbl>, and abbreviated variable names
## #   1: Diabetes_binary, 2: HighChol, 3: CholCheck, 4: HeartDiseaseorAttack,
## #   5: PhysActivity
```

#rename the “Diabetes_binary” column to “Diabetes” column to match columns with other dataframes

```
names(diabetes_indicator_5050split_df)[names(diabetes_indicator_5050split_df) == "Diabetes_binary"] <- '
diabetes_indicator_5050split_df
```

```
## # A tibble: 50 x 22
##    Diabetes HighBP HighChol CholCheck   BMI Smoker Stroke Heart~1 PhysA~2 Fruits
##       <dbl>  <dbl>    <dbl>     <dbl> <dbl>  <dbl>  <dbl>   <dbl>   <dbl>  <dbl>
##  1        0      1        0         1    26      0      0       0       1      0
##  2        0      1        1         1    26      1      1       0       0      1
##  3        0      0        0         1    26      0      0       0       1      1
##  4        0      1        1         1    28      1      0       0       1      1
##  5        0      0        0         1    29      1      0       0       1      1
##  6        0      0        0         1    18      0      0       0       1      1
##  7        0      0        1         1    26      1      0       0       1      1
##  8        0      0        0         1    31      1      0       0       0      1
##  9        0      0        0         1    32      0      0       0       1      1
## 10        0      0        0         1    27      1      0       0       0      1
## # ... with 40 more rows, 12 more variables: Veggies <dbl>,
## #   HvyAlcoholConsump <dbl>, AnyHealthcare <dbl>, NoDocbcCost <dbl>,
## #   GenHlth <dbl>, MentHlth <dbl>, PhysHlth <dbl>, DiffWalk <dbl>, Sex <dbl>,
## #   Age <dbl>, Education <dbl>, Income <dbl>, and abbreviated variable names
## #   1: HeartDiseaseorAttack, 2: PhysActivity
```

```r
summary(diabetes_indicator_5050split_df)
```

```
##     Diabetes     HighBP        HighChol      CholCheck      BMI
##  Min.   :0   Min.   :0.00   Min.   :0.00   Min.   :1   Min.   :18.00
##  1st Qu.:0   1st Qu.:0.00   1st Qu.:0.00   1st Qu.:1   1st Qu.:24.00
##  Median :0   Median :0.00   Median :0.00   Median :1   Median :26.50
##  Mean   :0   Mean   :0.32   Mean   :0.38   Mean   :1   Mean   :27.56
##  3rd Qu.:0   3rd Qu.:1.00   3rd Qu.:1.00   3rd Qu.:1   3rd Qu.:29.75
##  Max.   :0   Max.   :1.00   Max.   :1.00   Max.   :1   Max.   :58.00
##      Smoker          Stroke     HeartDiseaseorAttack  PhysActivity
##  Min.   :0.00   Min.   :0.00   Min.   :0.00         Min.   :0.00
##  1st Qu.:0.00   1st Qu.:0.00   1st Qu.:0.00         1st Qu.:1.00
##  Median :0.00   Median :0.00   Median :0.00         Median :1.00
##  Mean   :0.46   Mean   :0.02   Mean   :0.04         Mean   :0.78
##  3rd Qu.:1.00   3rd Qu.:0.00   3rd Qu.:0.00         3rd Qu.:1.00
##  Max.   :1.00   Max.   :1.00   Max.   :1.00         Max.   :1.00
##      Fruits        Veggies     HvyAlcoholConsump AnyHealthcare   NoDocbcCost
##  Min.   :0.00   Min.   :0.00   Min.   :0.00      Min.   :0.00   Min.   :0.00
##  1st Qu.:0.25   1st Qu.:1.00   1st Qu.:0.00      1st Qu.:1.00   1st Qu.:0.00
##  Median :1.00   Median :1.00   Median :0.00      Median :1.00   Median :0.00
##  Mean   :0.74   Mean   :0.86   Mean   :0.06      Mean   :0.96   Mean   :0.04
##  3rd Qu.:1.00   3rd Qu.:1.00   3rd Qu.:0.00      3rd Qu.:1.00   3rd Qu.:0.00
##  Max.   :1.00   Max.   :1.00   Max.   :1.00      Max.   :1.00   Max.   :1.00
##     GenHlth        MentHlth        PhysHlth        DiffWalk         Sex
##  Min.   :1.00   Min.   : 0.00   Min.   : 0.00   Min.   :0.00   Min.   :0.0
##  1st Qu.:2.00   1st Qu.: 0.00   1st Qu.: 0.00   1st Qu.:0.00   1st Qu.:0.0
##  Median :2.00   Median : 0.00   Median : 0.00   Median :0.00   Median :0.5
##  Mean   :2.32   Mean   : 1.76   Mean   : 3.36   Mean   :0.06   Mean   :0.5
##  3rd Qu.:3.00   3rd Qu.: 0.00   3rd Qu.: 3.00   3rd Qu.:0.00   3rd Qu.:1.0
##  Max.   :5.00   Max.   :30.00   Max.   :30.00   Max.   :1.00   Max.   :1.0
##       Age          Education        Income
##  Min.   : 1.00   Min.   :4.00   Min.   :1.0
##  1st Qu.: 5.00   1st Qu.:5.00   1st Qu.:6.0
##  Median : 8.00   Median :5.00   Median :7.0
##  Mean   : 7.54   Mean   :5.12   Mean   :6.4
##  3rd Qu.:10.00   3rd Qu.:6.00   3rd Qu.:8.0
##  Max.   :13.00   Max.   :6.00   Max.   :8.0
```

```r
describe(diabetes_indicator_5050split_df)
```

```
##                          vars  n  mean   sd median trimmed  mad min max range  skew
## Diabetes                    1 50  0.00 0.00    0.0    0.00 0.00   0   0     0   NaN
## HighBP                      2 50  0.32 0.47    0.0    0.28 0.00   0   1     1  0.75
## HighChol                    3 50  0.38 0.49    0.0    0.35 0.00   0   1     1  0.48
## CholCheck                   4 50  1.00 0.00    1.0    1.00 0.00   1   1     0   NaN
## BMI                         5 50 27.56 7.28   26.5   26.55 4.45  18  58    40  1.82
## Smoker                      6 50  0.46 0.50    0.0    0.45 0.00   0   1     1  0.16
## Stroke                      7 50  0.02 0.14    0.0    0.00 0.00   0   1     1  6.65
## HeartDiseaseorAttack        8 50  0.04 0.20    0.0    0.00 0.00   0   1     1  4.55
## PhysActivity                9 50  0.78 0.42    1.0    0.85 0.00   0   1     1 -1.31
## Fruits                     10 50  0.74 0.44    1.0    0.80 0.00   0   1     1 -1.06
## Veggies                    11 50  0.86 0.35    1.0    0.95 0.00   0   1     1 -2.01
```

```
## HvyAlcoholConsump      12 50  0.06 0.24    0.0    0.00 0.00   0   1     1  3.59
## AnyHealthcare          13 50  0.96 0.20    1.0    1.00 0.00   0   1     1 -4.55
## NoDocbcCost            14 50  0.04 0.20    0.0    0.00 0.00   0   1     1  4.55
## GenHlth                15 50  2.32 1.06    2.0    2.22 1.48   1   5     4  0.57
## MentHlth               16 50  1.76 5.21    0.0    0.48 0.00   0  30    30  4.06
## PhysHlth               17 50  3.36 7.59    0.0    1.23 0.00   0  30    30  2.68
## DiffWalk               18 50  0.06 0.24    0.0    0.00 0.00   0   1     1  3.59
## Sex                    19 50  0.50 0.51    0.5    0.50 0.74   0   1     1  0.00
## Age                    20 50  7.54 3.13    8.0    7.53 2.97   1  13    12 -0.05
## Education              21 50  5.12 0.77    5.0    5.15 1.48   4   6     2 -0.20
## Income                 22 50  6.40 2.06    7.0    6.78 1.48   1   8     7 -1.23
##                      kurtosis   se
## Diabetes                  NaN 0.00
## HighBP                  -1.47 0.07
## HighChol                -1.80 0.07
## CholCheck                 NaN 0.00
## BMI                      4.82 1.03
## Smoker                  -2.01 0.07
## Stroke                  43.12 0.02
## HeartDiseaseorAttack    19.13 0.03
## PhysActivity            -0.28 0.06
## Fruits                  -0.89 0.06
## Veggies                  2.10 0.05
## HvyAlcoholConsump       11.15 0.03
## AnyHealthcare           19.13 0.03
## NoDocbcCost             19.13 0.03
## GenHlth                 -0.22 0.15
## MentHlth                17.29 0.74
## PhysHlth                 6.31 1.07
## DiffWalk                11.15 0.03
## Sex                     -2.04 0.07
## Age                     -1.02 0.44
## Education               -1.34 0.11
## Income                   0.41 0.29
```

Load the dataset 3

```
excel_sheets('diabetes_indicator.xlsx')
```

```
## [1] "Sheet1"
```

```
diabetes_binary_df <- read_excel('diabetes_binary.xlsx',  sheet='Sheet1')
diabetes_binary_df
```

```
## # A tibble: 50 x 22
##    Diabetes_~1 HighBP HighC~2 CholC~3   BMI Smoker Stroke Heart~4 PhysA~5 Fruits
##          <dbl>  <dbl>   <dbl>   <dbl> <dbl>  <dbl>  <dbl>   <dbl>   <dbl>  <dbl>
##  1           0      1       1       1    40      1      0       0       0      0
##  2           0      0       0       0    25      1      0       0       1      0
##  3           0      1       1       1    28      0      0       0       0      1
##  4           0      1       0       1    27      0      0       0       1      1
```

```
##  5           0      1       1       1    24      0      0       0       1      1
##  6           0      1       1       1    25      1      0       0       1      1
##  7           0      1       0       1    30      1      0       0       0      0
##  8           0      1       1       1    25      1      0       0       1      0
##  9           1      1       1       1    30      1      0       1       0      1
## 10           0      0       0       1    24      0      0       0       0      0
## # ... with 40 more rows, 12 more variables: Veggies <dbl>,
## #   HvyAlcoholConsump <dbl>, AnyHealthcare <dbl>, NoDocbcCost <dbl>,
## #   GenHlth <dbl>, MentHlth <dbl>, PhysHlth <dbl>, DiffWalk <dbl>, Sex <dbl>,
## #   Age <dbl>, Education <dbl>, Income <dbl>, and abbreviated variable names
## #   1: Diabetes_binary, 2: HighChol, 3: CholCheck, 4: HeartDiseaseorAttack,
## #   5: PhysActivity
```

#rename the "Diabetes_binary" column to "Diabetes" column to match columns with other dataframes

```
names(diabetes_binary_df)[names(diabetes_binary_df) == "Diabetes_binary"] <- "Diabetes"
diabetes_binary_df
```

```
## # A tibble: 50 x 22
##    Diabetes HighBP HighChol CholCheck   BMI Smoker Stroke Heart~1 PhysA~2 Fruits
##       <dbl>  <dbl>    <dbl>     <dbl> <dbl>  <dbl>  <dbl>   <dbl>   <dbl>  <dbl>
##  1        0      1        1         1    40      1      0       0       0      0
##  2        0      0        0         0    25      1      0       0       1      0
##  3        0      1        1         1    28      0      0       0       0      1
##  4        0      1        0         1    27      0      0       0       1      1
##  5        0      1        1         1    24      0      0       0       1      1
##  6        0      1        1         1    25      1      0       0       1      1
##  7        0      1        0         1    30      1      0       0       0      0
##  8        0      1        1         1    25      1      0       0       1      0
##  9        1      1        1         1    30      1      0       1       0      1
## 10        0      0        0         1    24      0      0       0       0      0
## # ... with 40 more rows, 12 more variables: Veggies <dbl>,
## #   HvyAlcoholConsump <dbl>, AnyHealthcare <dbl>, NoDocbcCost <dbl>,
## #   GenHlth <dbl>, MentHlth <dbl>, PhysHlth <dbl>, DiffWalk <dbl>, Sex <dbl>,
## #   Age <dbl>, Education <dbl>, Income <dbl>, and abbreviated variable names
## #   1: HeartDiseaseorAttack, 2: PhysActivity
```

```
summary(diabetes_binary_df)
```

```
##     Diabetes         HighBP         HighChol       CholCheck          BMI
##  Min.   :0.00   Min.   :0.00   Min.   :0.00   Min.   :0.00   Min.   :21.00
##  1st Qu.:0.00   1st Qu.:0.00   1st Qu.:0.00   1st Qu.:1.00   1st Qu.:24.25
##  Median :0.00   Median :1.00   Median :1.00   Median :1.00   Median :27.50
##  Mean   :0.24   Mean   :0.62   Mean   :0.54   Mean   :0.96   Mean   :28.06
##  3rd Qu.:0.00   3rd Qu.:1.00   3rd Qu.:1.00   3rd Qu.:1.00   3rd Qu.:31.00
##  Max.   :1.00   Max.   :1.00   Max.   :1.00   Max.   :1.00   Max.   :40.00
##      Smoker         Stroke    HeartDiseaseorAttack  PhysActivity      Fruits
##  Min.   :0.0   Min.   :0.0   Min.   :0.0          Min.   :0.00   Min.   :0.00
##  1st Qu.:0.0   1st Qu.:0.0   1st Qu.:0.0          1st Qu.:0.00   1st Qu.:0.00
##  Median :1.0   Median :0.0   Median :0.0          Median :1.00   Median :1.00
##  Mean   :0.6   Mean   :0.1   Mean   :0.1          Mean   :0.52   Mean   :0.58
##  3rd Qu.:1.0   3rd Qu.:0.0   3rd Qu.:0.0          3rd Qu.:1.00   3rd Qu.:1.00
```

```
##  Max.   :1.0   Max.   :1.0   Max.   :1.0          Max.   :1.00   Max.   :1.00
##     Veggies     HvyAlcoholConsump AnyHealthcare  NoDocbcCost      GenHlth
##  Min.   :0.00   Min.   :0.00      Min.   :0.0   Min.   :0.00   Min.   :1.00
##  1st Qu.:1.00   1st Qu.:0.00      1st Qu.:1.0   1st Qu.:0.00   1st Qu.:2.00
##  Median :1.00   Median :0.00      Median :1.0   Median :0.00   Median :3.00
##  Mean   :0.76   Mean   :0.02      Mean   :0.9   Mean   :0.08   Mean   :2.82
##  3rd Qu.:1.00   3rd Qu.:0.00      3rd Qu.:1.0   3rd Qu.:0.00   3rd Qu.:3.00
##  Max.   :1.00   Max.   :1.00      Max.   :1.0   Max.   :1.00   Max.   :5.00
##     MentHlth        PhysHlth        DiffWalk          Sex            Age
##  Min.   : 0.0   Min.   : 0.00   Min.   :0.00   Min.   :0.00   Min.   : 2.00
##  1st Qu.: 0.0   1st Qu.: 0.00   1st Qu.:0.00   1st Qu.:0.00   1st Qu.: 7.00
##  Median : 0.0   Median : 0.00   Median :0.00   Median :0.00   Median : 9.00
##  Mean   : 6.5   Mean   : 6.80   Mean   :0.34   Mean   :0.32   Mean   : 8.94
##  3rd Qu.: 9.0   3rd Qu.: 9.25   3rd Qu.:1.00   3rd Qu.:1.00   3rd Qu.:11.00
##  Max.   :30.0   Max.   :30.00   Max.   :1.00   Max.   :1.00   Max.   :13.00
##    Education       Income
##  Min.   :2.0   Min.   :1.00
##  1st Qu.:4.0   1st Qu.:3.00
##  Median :5.0   Median :4.00
##  Mean   :4.7   Mean   :4.86
##  3rd Qu.:6.0   3rd Qu.:7.00
##  Max.   :6.0   Max.   :8.00
```

```
describe(diabetes_binary_df)
```

```
##                       vars  n  mean    sd median trimmed  mad min max range
## Diabetes                 1 50  0.24  0.43    0.0    0.17 0.00   0   1     1
## HighBP                   2 50  0.62  0.49    1.0    0.65 0.00   0   1     1
## HighChol                 3 50  0.54  0.50    1.0    0.55 0.00   0   1     1
## CholCheck                4 50  0.96  0.20    1.0    1.00 0.00   0   1     1
## BMI                      5 50 28.06  4.65   27.5   27.70 5.19  21  40    19
## Smoker                   6 50  0.60  0.49    1.0    0.62 0.00   0   1     1
## Stroke                   7 50  0.10  0.30    0.0    0.00 0.00   0   1     1
## HeartDiseaseorAttack     8 50  0.10  0.30    0.0    0.00 0.00   0   1     1
## PhysActivity             9 50  0.52  0.50    1.0    0.52 0.00   0   1     1
## Fruits                  10 50  0.58  0.50    1.0    0.60 0.00   0   1     1
## Veggies                 11 50  0.76  0.43    1.0    0.82 0.00   0   1     1
## HvyAlcoholConsump       12 50  0.02  0.14    0.0    0.00 0.00   0   1     1
## AnyHealthcare           13 50  0.90  0.30    1.0    1.00 0.00   0   1     1
## NoDocbcCost             14 50  0.08  0.27    0.0    0.00 0.00   0   1     1
## GenHlth                 15 50  2.82  1.16    3.0    2.78 1.48   1   5     4
## MentHlth                16 50  6.50 10.63    0.0    4.38 0.00   0  30    30
## PhysHlth                17 50  6.80 11.12    0.0    4.75 0.00   0  30    30
## DiffWalk                18 50  0.34  0.48    0.0    0.30 0.00   0   1     1
## Sex                     19 50  0.32  0.47    0.0    0.28 0.00   0   1     1
## Age                     20 50  8.94  2.78    9.0    9.10 2.97   2  13    11
## Education               21 50  4.70  1.11    5.0    4.80 1.48   2   6     4
## Income                  22 50  4.86  2.35    4.0    4.92 2.97   1   8     7
##                        skew kurtosis   se
## Diabetes               1.18    -0.62 0.06
## HighBP                -0.48    -1.80 0.07
## HighChol              -0.16    -2.01 0.07
## CholCheck             -4.55    19.13 0.03
## BMI                    0.60    -0.42 0.66
```

```
## Smoker                -0.40    -1.88 0.07
## Stroke                 2.59     4.79 0.04
## HeartDiseaseorAttack   2.59     4.79 0.04
## PhysActivity          -0.08    -2.03 0.07
## Fruits                -0.31    -1.94 0.07
## Veggies               -1.18    -0.62 0.06
## HvyAlcoholConsump      6.65    43.12 0.02
## AnyHealthcare         -2.59     4.79 0.04
## NoDocbcCost            3.00     7.17 0.04
## GenHlth                0.42    -0.64 0.16
## MentHlth               1.36     0.24 1.50
## PhysHlth               1.32     0.06 1.57
## DiffWalk               0.66    -1.60 0.07
## Sex                    0.75    -1.47 0.07
## Age                   -0.46    -0.55 0.39
## Education             -0.45    -0.55 0.16
## Income                -0.01    -1.41 0.33
```

Bind all the three datasets into one dataset

```
library(dplyr)
```

```
##
## 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
```

```
diabetes_df <- bind_rows(diabetes_indicator_df, diabetes_indicator_5050split_df, diabetes_binary_df)
diabetes_df
```

```
## # A tibble: 150 x 22
##    Diabetes HighBP HighChol CholCheck   BMI Smoker Stroke Heart~1 PhysA~2 Fruits
##       <dbl>  <dbl>    <dbl>     <dbl> <dbl>  <dbl>  <dbl>   <dbl>   <dbl>  <dbl>
##  1        0      1        1         1    40      1      0       0       0      0
##  2        0      0        0         0    25      1      0       0       1      0
##  3        0      1        1         1    28      0      0       0       0      1
##  4        0      1        0         1    27      0      0       0       1      1
##  5        0      1        1         1    24      0      0       0       1      1
##  6        0      1        1         1    25      1      0       0       1      1
##  7        0      1        0         1    30      1      0       0       0      0
##  8        0      1        1         1    25      1      0       0       1      0
##  9        2      1        1         1    30      1      0       1       0      1
## 10        0      0        0         1    24      0      0       0       0      0
## # ... with 140 more rows, 12 more variables: Veggies <dbl>,
```

```
## #   HvyAlcoholConsump <dbl>, AnyHealthcare <dbl>, NoDocbcCost <dbl>,
## #   GenHlth <dbl>, MentHlth <dbl>, PhysHlth <dbl>, DiffWalk <dbl>, Sex <dbl>,
## #   Age <dbl>, Education <dbl>, Income <dbl>, and abbreviated variable names
## #   1: HeartDiseaseorAttack, 2: PhysActivity
```

```
summary(diabetes_df)
```

```
##     Diabetes        HighBP        HighChol        CholCheck
##  Min.   :0.00   Min.   :0.00   Min.   :0.0000   Min.   :0.0000
##  1st Qu.:0.00   1st Qu.:0.00   1st Qu.:0.0000   1st Qu.:1.0000
##  Median :0.00   Median :1.00   Median :0.0000   Median :1.0000
##  Mean   :0.24   Mean   :0.52   Mean   :0.4867   Mean   :0.9733
##  3rd Qu.:0.00   3rd Qu.:1.00   3rd Qu.:1.0000   3rd Qu.:1.0000
##  Max.   :2.00   Max.   :1.00   Max.   :1.0000   Max.   :1.0000
##       BMI            Smoker           Stroke        HeartDiseaseorAttack
##  Min.   :18.00   Min.   :0.0000   Min.   :0.00000   Min.   :0.00
##  1st Qu.:24.00   1st Qu.:0.0000   1st Qu.:0.00000   1st Qu.:0.00
##  Median :27.00   Median :1.0000   Median :0.00000   Median :0.00
##  Mean   :27.89   Mean   :0.5533   Mean   :0.07333   Mean   :0.08
##  3rd Qu.:31.00   3rd Qu.:1.0000   3rd Qu.:0.00000   3rd Qu.:0.00
##  Max.   :58.00   Max.   :1.0000   Max.   :1.00000   Max.   :1.00
##   PhysActivity        Fruits          Veggies       HvyAlcoholConsump
##  Min.   :0.0000   Min.   :0.0000   Min.   :0.0000   Min.   :0.00000
##  1st Qu.:0.0000   1st Qu.:0.0000   1st Qu.:1.0000   1st Qu.:0.00000
##  Median :1.0000   Median :1.0000   Median :1.0000   Median :0.00000
##  Mean   :0.6067   Mean   :0.6333   Mean   :0.7933   Mean   :0.03333
##  3rd Qu.:1.0000   3rd Qu.:1.0000   3rd Qu.:1.0000   3rd Qu.:0.00000
##  Max.   :1.0000   Max.   :1.0000   Max.   :1.0000   Max.   :1.00000
##  AnyHealthcare   NoDocbcCost         GenHlth         MentHlth
##  Min.   :0.00   Min.   :0.00000   Min.   :1.000   Min.   : 0.00
##  1st Qu.:1.00   1st Qu.:0.00000   1st Qu.:2.000   1st Qu.: 0.00
##  Median :1.00   Median :0.00000   Median :3.000   Median : 0.00
##  Mean   :0.92   Mean   :0.06667   Mean   :2.653   Mean   : 4.92
##  3rd Qu.:1.00   3rd Qu.:0.00000   3rd Qu.:3.000   3rd Qu.: 5.00
##  Max.   :1.00   Max.   :1.00000   Max.   :5.000   Max.   :30.00
##     PhysHlth         DiffWalk           Sex            Age
##  Min.   : 0.000   Min.   :0.0000   Min.   :0.00   Min.   : 1.000
##  1st Qu.: 0.000   1st Qu.:0.0000   1st Qu.:0.00   1st Qu.: 7.000
##  Median : 0.000   Median :0.0000   Median :0.00   Median : 9.000
##  Mean   : 5.653   Mean   :0.2467   Mean   :0.38   Mean   : 8.473
##  3rd Qu.: 5.750   3rd Qu.:0.0000   3rd Qu.:1.00   3rd Qu.:11.000
##  Max.   :30.000   Max.   :1.0000   Max.   :1.00   Max.   :13.000
##    Education        Income
##  Min.   :2.00   Min.   :1.000
##  1st Qu.:4.00   1st Qu.:3.000
##  Median :5.00   Median :6.000
##  Mean   :4.84   Mean   :5.373
##  3rd Qu.:6.00   3rd Qu.:8.000
##  Max.   :6.00   Max.   :8.000
```

```
describe(diabetes_df)
```

```
##                      vars    n  mean    sd median trimmed  mad min max range
```

```
## Diabetes                1 150  0.24  0.59      0    0.07 0.00   0   2     2
## HighBP                  2 150  0.52  0.50      1    0.52 0.00   0   1     1
## HighChol                3 150  0.49  0.50      0    0.48 0.00   0   1     1
## CholCheck               4 150  0.97  0.16      1    1.00 0.00   0   1     1
## BMI                     5 150 27.89  5.63     27   27.38 4.45  18  58    40
## Smoker                  6 150  0.55  0.50      1    0.57 0.00   0   1     1
## Stroke                  7 150  0.07  0.26      0    0.00 0.00   0   1     1
## HeartDiseaseorAttack    8 150  0.08  0.27      0    0.00 0.00   0   1     1
## PhysActivity            9 150  0.61  0.49      1    0.63 0.00   0   1     1
## Fruits                 10 150  0.63  0.48      1    0.67 0.00   0   1     1
## Veggies                11 150  0.79  0.41      1    0.87 0.00   0   1     1
## HvyAlcoholConsump      12 150  0.03  0.18      0    0.00 0.00   0   1     1
## AnyHealthcare          13 150  0.92  0.27      1    1.00 0.00   0   1     1
## NoDocbcCost            14 150  0.07  0.25      0    0.00 0.00   0   1     1
## GenHlth                15 150  2.65  1.14      3    2.58 1.48   1   5     4
## MentHlth               16 150  4.92  9.40      0    2.48 0.00   0  30    30
## PhysHlth               17 150  5.65 10.15      0    3.32 0.00   0  30    30
## DiffWalk               18 150  0.25  0.43      0    0.18 0.00   0   1     1
## Sex                    19 150  0.38  0.49      0    0.35 0.00   0   1     1
## Age                    20 150  8.47  2.96      9    8.58 2.97   1  13    12
## Education              21 150  4.84  1.02      5    4.93 1.48   2   6     4
## Income                 22 150  5.37  2.36      6    5.55 2.97   1   8     7
##                         skew kurtosis   se
## Diabetes                2.27     3.71 0.05
## HighBP                 -0.08    -2.01 0.04
## HighChol                0.05    -2.01 0.04
## CholCheck              -5.82    32.06 0.01
## BMI                     1.48     4.81 0.46
## Smoker                 -0.21    -1.97 0.04
## Stroke                  3.24     8.56 0.02
## HeartDiseaseorAttack    3.07     7.45 0.02
## PhysActivity           -0.43    -1.83 0.04
## Fruits                 -0.55    -1.71 0.04
## Veggies                -1.43     0.06 0.03
## HvyAlcoholConsump       5.15    24.66 0.01
## AnyHealthcare          -3.07     7.45 0.02
## NoDocbcCost             3.44     9.90 0.02
## GenHlth                 0.48    -0.44 0.09
## MentHlth                1.85     1.97 0.77
## PhysHlth                1.67     1.22 0.83
## DiffWalk                1.16    -0.65 0.04
## Sex                     0.49    -1.77 0.04
## Age                    -0.36    -0.72 0.24
## Education              -0.57    -0.20 0.08
## Income                 -0.36    -1.28 0.19
```

omit the data with Na values.

```
na.omit(diabetes_df)
```

```
## # A tibble: 150 x 22
##    Diabetes HighBP HighChol CholCheck   BMI Smoker Stroke Heart~1 PhysA~2 Fruits
```

```
##       <dbl>  <dbl>    <dbl>     <dbl> <dbl>  <dbl>  <dbl>   <dbl>   <dbl>  <dbl>
##  1        0      1        1         1    40      1      0       0       0      0
##  2        0      0        0         0    25      1      0       0       1      0
##  3        0      1        1         1    28      0      0       0       0      1
##  4        0      1        0         1    27      0      0       0       1      1
##  5        0      1        1         1    24      0      0       0       1      1
##  6        0      1        1         1    25      1      0       0       1      1
##  7        0      1        0         1    30      1      0       0       0      0
##  8        0      1        1         1    25      1      0       0       1      0
##  9        2      1        1         1    30      1      0       1       0      1
## 10        0      0        0         1    24      0      0       0       0      0
## # ... with 140 more rows, 12 more variables: Veggies <dbl>,
## #   HvyAlcoholConsump <dbl>, AnyHealthcare <dbl>, NoDocbcCost <dbl>,
## #   GenHlth <dbl>, MentHlth <dbl>, PhysHlth <dbl>, DiffWalk <dbl>, Sex <dbl>,
## #   Age <dbl>, Education <dbl>, Income <dbl>, and abbreviated variable names
## #   1: HeartDiseaseorAttack, 2: PhysActivity
```

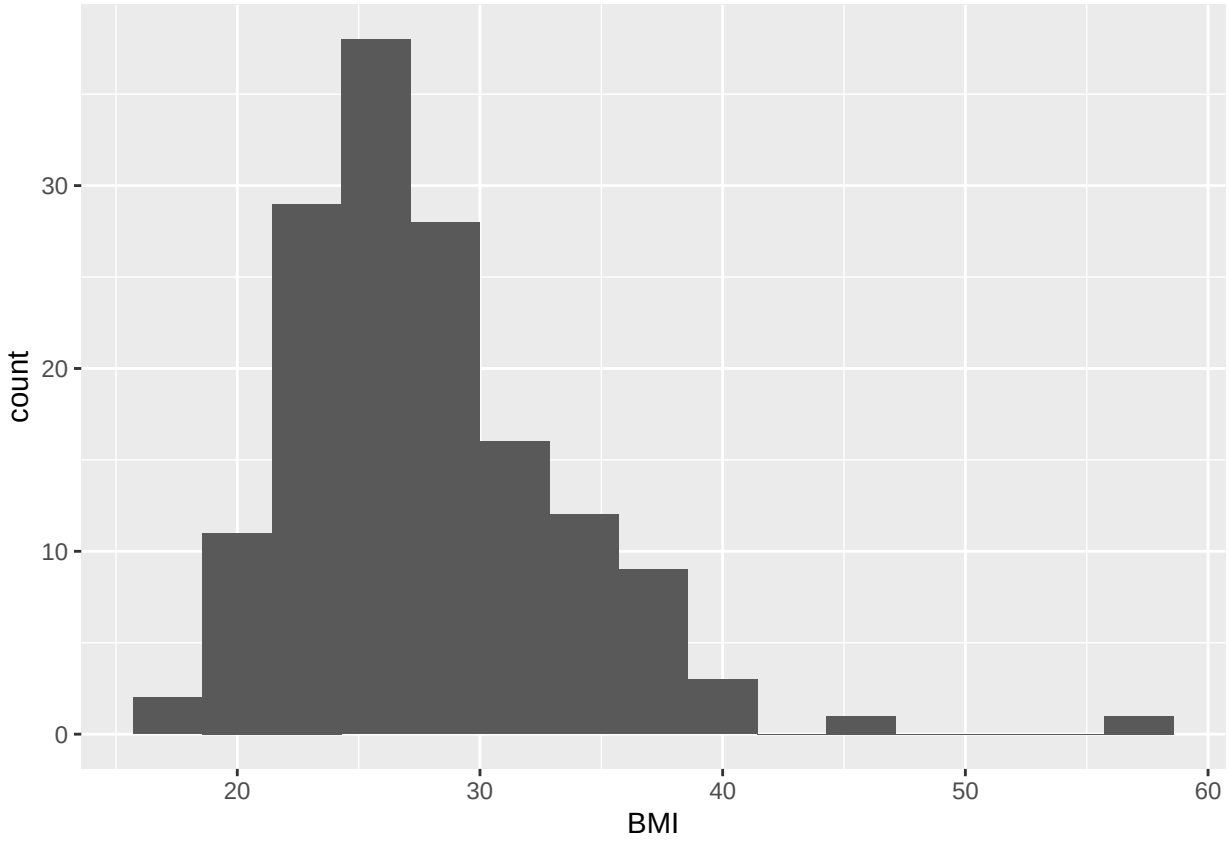
Here there are no NA values in the data

Analyze how Diabetes depends on BMI

```
# Create a Histogram of the BMI variable using the ggplot2 package.

library(ggplot2)
```

```
##
## Attaching package: 'ggplot2'

## The following objects are masked from 'package:psych':
##
##     %+%, alpha
```

```
ggplot(diabetes_df,aes(BMI)) + geom_histogram(bins = 15)
```

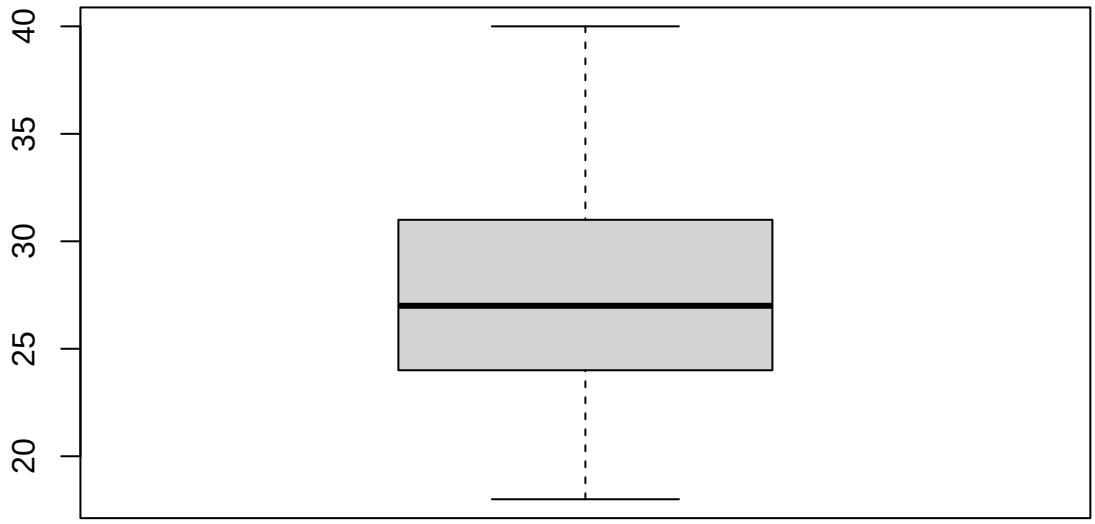



```
## remove the outliers
x <- diabetes_df$`BMI`                                          # Print data

x_out_rm <- x[!x %in% boxplot.stats(x)$out]     # Remove the outliers

length(x) - length(x_out_rm)                    # Count the removed observations
```

```
## [1] 2
```

Create boxplot without outliers

```
boxplot(x_out_rm)
```



Using GroupBy function from dplyr package to group by Diabetes

```
library(dplyr)
diabetes_df %>% group_by(Diabetes) %>% summarize(AvgBMI = mean(`BMI`))
```

```
## # A tibble: 3 x 2
##   Diabetes AvgBMI
##      <dbl>  <dbl>
## 1        0   27.7
## 2        1   28.9
## 3        2   28.9
```

0 = no diabetes 1 = prediabetes 2 = diabetes So, based on the above analysis, the BMI should be maintained around 27.7 in order to reduce the chances of Diabetes.

Furthur analysis will be done on other predictors

References

Datasets from Kaggle website