p8130 HW4 Regression

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Problem 2 Heart disease

We are interested in fi there is an association between **total cost** in dollars diagnosed with heart disease and the **number of ER visits**. Other factors will be adjusted later on.

a) short description of data and look at the data

```
heart_disease <- read_csv("./data/HeartDisease.csv")
```

```
## Parsed with column specification:
## cols(
##   id = col_integer(),
##   totalcost = col_double(),
##   age = col_integer(),
##   gender = col_integer(),
##   interventions = col_integer(),
##   drugs = col_integer(),
##   ERvisits = col_integer(),
##   complications = col_integer(),
##   comorbidities = col_integer(),
##   duration = col_integer()
## )
```

```
head(heart_disease)
```

```
## # A tibble: 6 x 10
##      id totalcost   age gender interventions drugs ERvisits complications
##   <int>     <dbl> <int>  <int>         <int> <int>    <int>         <int>
## 1     1      179.    63      0             2     1        4             0
## 2     2      319     59      0             2     0        6             0
## 3     3     9311.    62      0            17     0        2             0
## 4     4      281.    60      1             9     0        7             0
## 5     5    18727.    55      0             5     2        7             0
## 6     6      453.    66      0             1     0        3             0
## # ... with 2 more variables: comorbidities <int>, duration <int>
```

In this dataset, there are 788 observations of patients with 10 variables:

- **id**: patient id
- **totalcost**: total cost ($) of patients who are diagnosed with heart disease
- **age**: age of patients
- **interventions**: number of interventions (integers)
- **drugs**: ? number of drugs.
- **ERvisits**: number of ER visits
- **complications**: number of complications
- **comorbidities**: number of co-presence of other diseases in additional to heart disease
- **duration**: duration of heart disease (in days)

Based our investigation interest, the main outcome is **total cost** of patients with heart disease and the main predictor is **ERvisits** (number of ER visits). Other important covariates also need to be considered because they could potential have differential effect on the association relationship between out main predictor and main outcome, including age, interventions, drugs used, complications, and duration of disease. We will first take a look at these variables:

i) First we took a look at the main outcome and main predictor

number summaries for variables:

```
variable_set1 <- dplyr::select(heart_disease, totalcost, ERvisits, everything(), -c(id, gender, complica
variable_set2 <- dplyr::select(heart_disease, gender, complications)
knitr::kable(summary(variable_set1))
```

totalcost	ERvisits	age	interventions	drugs	comorbidities	duration
Min. : 0.0	Min. : 0.000	Min. :24.00	Min. : 0.000	Min. :0.0000	Min. : 0.000	Min. : 0.00
1st Qu.: 161.1	1st Qu.: 2.000	1st Qu.:55.00	1st Qu.: 1.000	1st Qu.:0.0000	1st Qu.: 0.000	1st Qu.: 41.75
Median : 507.2	Median : 3.000	Median :60.00	Median : 3.000	Median :0.0000	Median : 1.000	Median :165.5
Mean : 2800.0	Mean : 3.425	Mean :58.72	Mean : 4.707	Mean :0.4467	Mean : 3.767	Mean :164.03
3rd Qu.: 1905.5	3rd Qu.: 5.000	3rd Qu.:64.00	3rd Qu.: 6.000	3rd Qu.:0.0000	3rd Qu.: 5.000	3rd Qu.:281.0
Max. :52664.9	Max. :20.000	Max. :70.00	Max. :47.000	Max. :9.0000	Max. :60.000	Max. :372.00

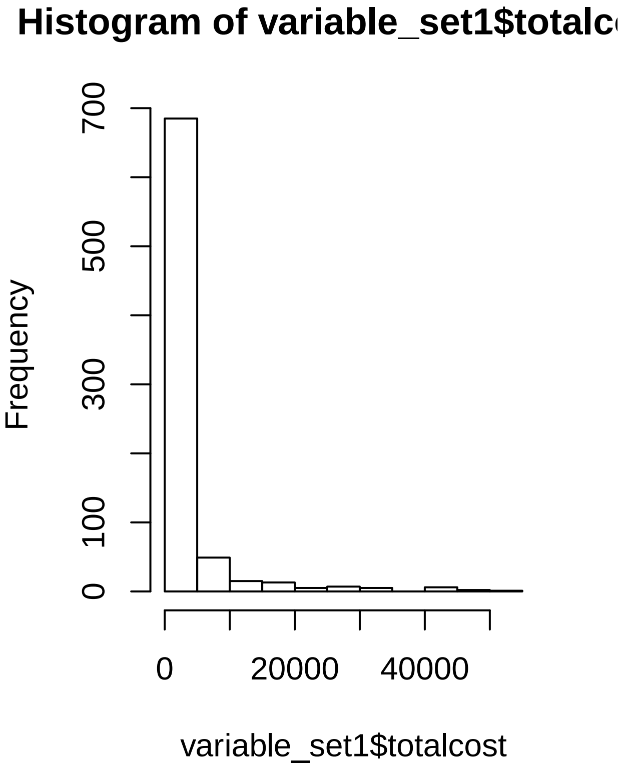
```
table(variable_set2)
```

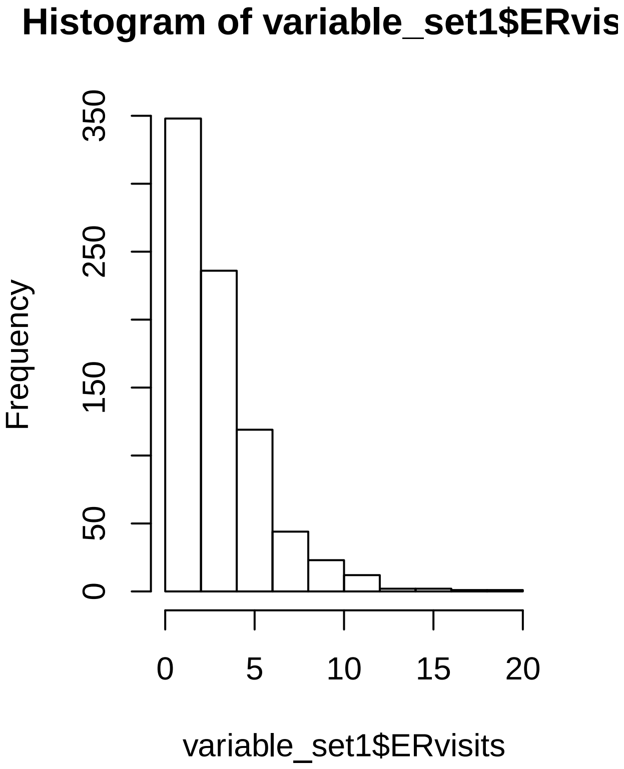
```
##       complications
## gender   0   1   3
##      0 576  32   0
##      1 169  10   1
```

```
#margin.table(table(variable_set2))
#prop.table(table(variable_set2))
```

Visualize the distribution of these variables

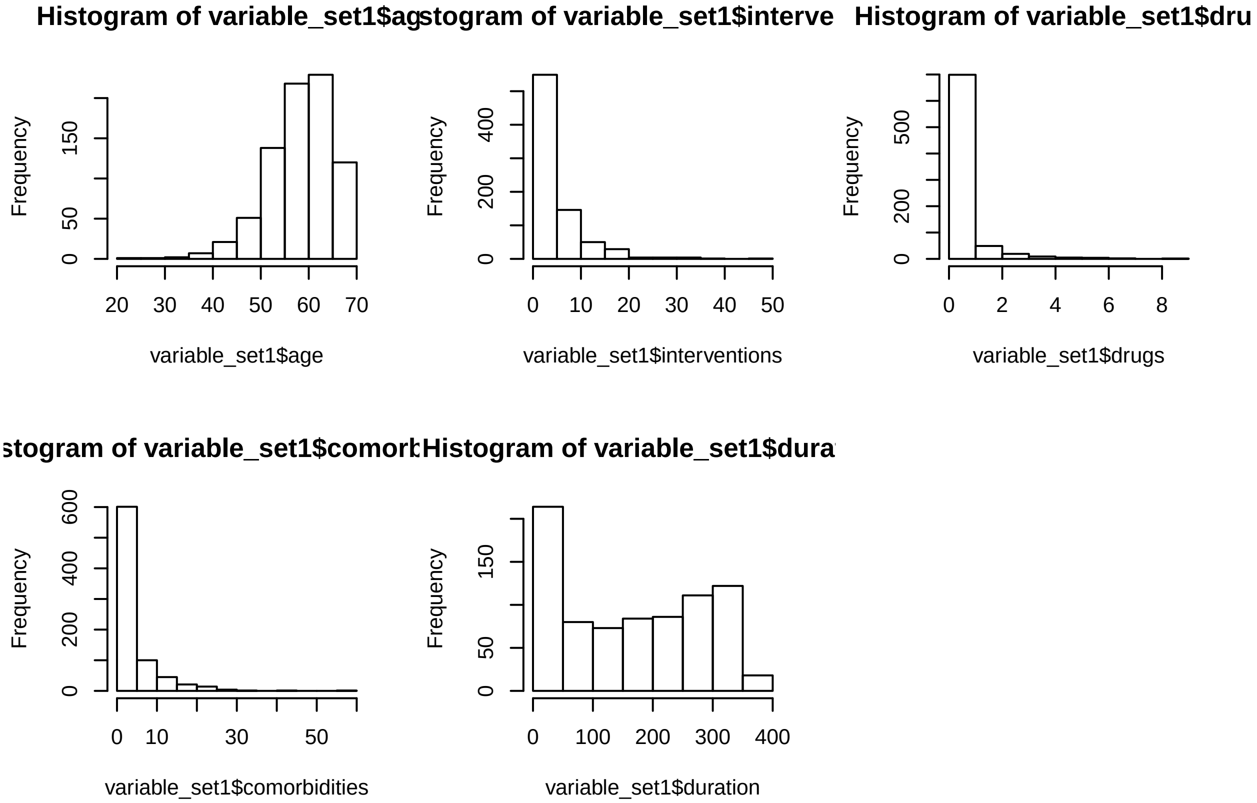
```
par(mfrow = c(1,2))
hist(variable_set1$totalcost)
hist(variable_set1$ERvisits)
```





Comment: Since total cost and ER visits are both heavily right skewed on the histograms, we better use median and IQR in the summay table to describe them. Especially for total cost, there are many extreme values at the right tail end which needed to be investigated further in the following analysis.

```
par(mfrow = c(2,3))
hist(variable_set1$age)
hist(variable_set1$interventions)
hist(variable_set1$drugs)
hist(variable_set1$comorbidities)
hist(variable_set1$duration)
```



Comment: age is slightly left skewed which means elder people have been overly sampled. The median of intervention is about 5 with large IQR of 5. drugs?. Commordities have median of 3.7 with large IQR 5. Duration of heart disease is roughly uniformly distributed from 50 to 350 days with median 165 days and IQR 240 days. Therefore, these co-variables are not normally distributed in the sample, so we need to adjust for this in later analysis.