

Smoke And Die

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Downloading Raw Data

```
download.file(url = "https://raw.githubusercontent.com/leanne8/smoke_and_die/master/rawdata/smoke_df.csv",
              destfile = "../rawdata/smoke_df.csv")

download.file(url = "https://raw.githubusercontent.com/leanne8/smoke_and_die/master/rawdata/lung_cancer_df.csv",
              destfile = "../rawdata/lung_cancer_df.csv")
```

Data Cleaning and Preparation

```
smoke_df <- read.csv(file = "../rawdata/smoke_df.csv",
                    header = TRUE, stringsAsFactors = FALSE)
lung_cancer_df <- read.csv(file = "../rawdata/lung_cancer_df.csv",
                          header = TRUE, stringsAsFactors = FALSE)

smoke_df <- smoke_df[, c(1, 2)]
colnames(smoke_df) <- c("state", "smokers(%)")

lung_cancer_df <- lung_cancer_df[, c(1, 3)]
colnames(lung_cancer_df) <- c("state", "cancer(%)")
lung_cancer_df[, 2] <- as.numeric(lung_cancer_df[, 2])
```

Warning: NAs introduced by coercion

```
lung_cancer_df[lung_cancer_df$state == "NV", 2] <-
  round((1683/2685000) * 100000, digits = 1)
lung_cancer_df[, 2] <- lung_cancer_df[, 2] / 1000

smoke_cancer_df <- cbind(smoke_df, lung_cancer_df)
smoke_cancer_df[, 3] <- NULL

write.table(smoke_df, file = "../data/smoke_cdf.csv", sep = ",",
            row.names = FALSE, col.names = TRUE)
write.table(lung_cancer_df, file = "../data/lung_cancer_cdf.csv", sep = ",",
            row.names = FALSE, col.names = TRUE)
write.table(smoke_cancer_df, file = "../data/smoke_cancer_cdf.csv",
            row.names = FALSE, col.names = TRUE, sep = ",")
```

Basic Clean Data Inspection

Inspection for smoking population

```
smoke_cdf <- read.csv(file = "../data/smoke_cdf.csv",
                      header = TRUE, stringsAsFactors = FALSE)
str(smoke_cdf)
```

```
## 'data.frame': 51 obs. of 2 variables:
## $ state : chr "Alabama" "Alaska" "Arizona" "Arkansas" ...
## $ smokers...: num 21.5 22.6 16.3 25.9 12.5 17.7 15.5 19.6 18.8 16.8 ...
```

```
summary(smoke_cdf)
```

```
##      state      smokers...
## Length:51      Min.   :10.30
## Class :character 1st Qu.:16.70
## Mode  :character Median :19.00
##                      Mean  :19.31
##                      3rd Qu.:21.45
##                      Max.   :27.30
```

```
head(smoke_cdf)
```

```
##      state smokers...
## 1    Alabama      21.5
## 2    Alaska       22.6
## 3    Arizona       16.3
## 4    Arkansas      25.9
## 5 California      12.5
## 6    Colorado      17.7
```

```
tail(smoke_cdf)
```

```
##      state smokers...
## 46    Vermont      16.6
## 47    Virginia     19.0
## 48    Washington    16.1
## 49 West Virginia    27.3
## 50    Wisconsin     18.7
## 51    Wyoming       20.6
```

Inspection for lung cancer rate

```
lung_cancer_cdf <- read.csv(file = "../data/lung_cancer_cdf.csv",
                             header = TRUE, stringsAsFactors = FALSE)
str(lung_cancer_cdf)
```

```
## 'data.frame': 51 obs. of 2 variables:
## $ state : chr "AL" "AK" "AZ" "AR" ...
## $ cancer...: num 0.0696 0.0572 0.0494 0.0751 0.0442 0.0449 0.061 0.0679 0.0612 0.0612 ...
```

```
summary(lung_cancer_cdf)
```

```
##      state      cancer...  
## Length:51      Min.    :0.02990  
## Class :character 1st Qu.:0.05565  
## Mode  :character Median :0.06120  
##                      Mean  :0.06138  
##                      3rd Qu.:0.06780  
##                      Max.   :0.09240
```

```
head(lung_cancer_cdf)
```

```
## state cancer...  
## 1    AL    0.0696  
## 2    AK    0.0572  
## 3    AZ    0.0494  
## 4    AR    0.0751  
## 5    CA    0.0442  
## 6    CO    0.0449
```

```
tail(lung_cancer_cdf)
```

```
## state cancer...  
## 46   VT    0.0624  
## 47   VA    0.0606  
## 48   WA    0.0588  
## 49   WV    0.0771  
## 50   WI    0.0589  
## 51   WY    0.0480
```

Combine smoking population data frame and lung cancer rate data frame

```
smoke_cancer_cdf <- read.csv(file = "../data/smoke_cancer_cdf.csv",  
                             header = TRUE, stringsAsFactors = FALSE)  
smoke_cancer_cdf$state[which.max(smoke_cancer_cdf$smokers...)]
```

```
## [1] "West Virginia"
```

The state with the lowest smoking population rate

```
smoke_cancer_cdf$state[which.min(smoke_cancer_cdf$smokers...)]
```

```
## [1] "Utah"
```

The state with the highest lung cancer rate

```
smoke_cancer_cdf$state[which.max(smoke_cancer_cdf$cancer...)]
```

```
## [1] "Kentucky"
```

The state with the lowest lung cancer rate

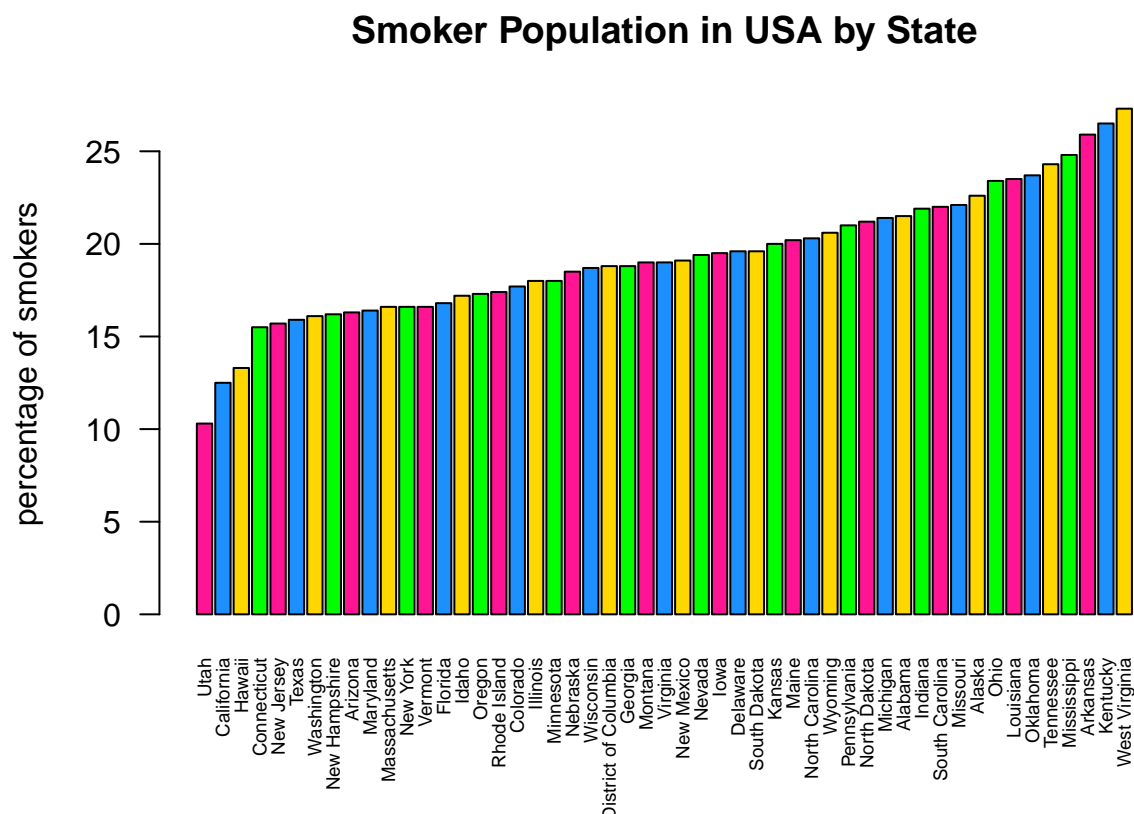
```
smoke_cancer_cdf$state[which.min(smoke_cancer_cdf$cancer...)]
```

```
## [1] "Utah"
```

Visualization Part 1

In the graph of “Smoker Population in USA by State”, we ordered the percentage of smokers in ascending order by states. It shows that West Virginia has the highest percentage of smokers and Utah has the lowest percentage of smoking across the United States.

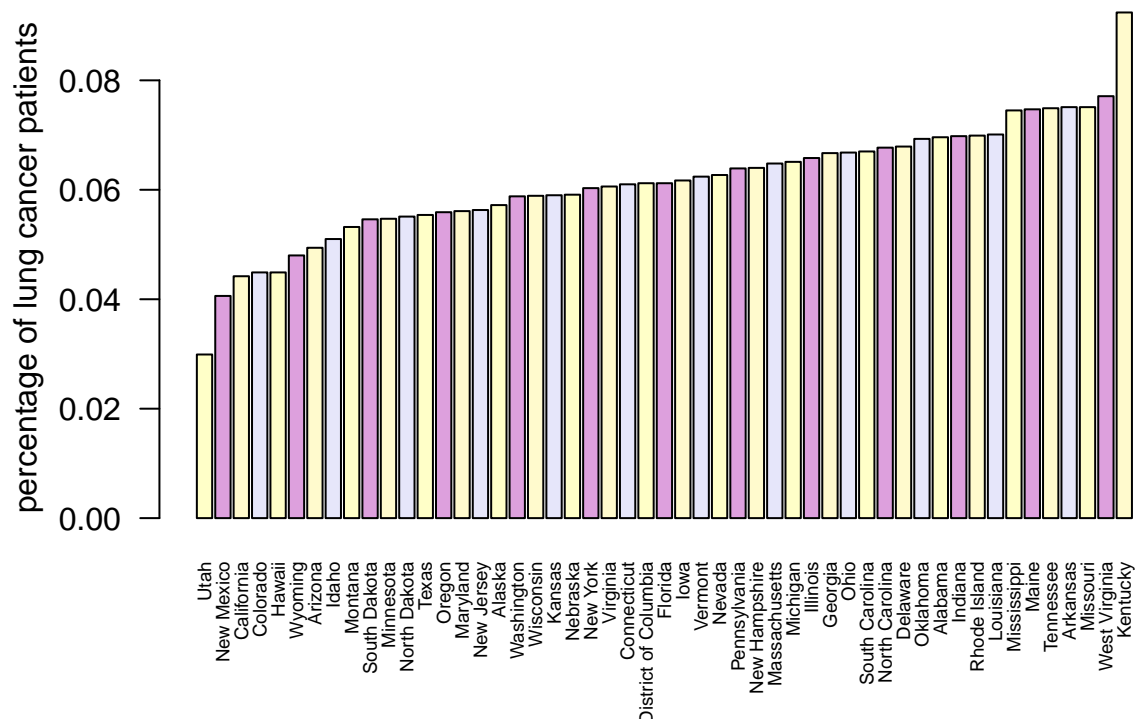
```
smoker_perc <- smoke_cancer_cdf$smokers...
names(smoker_perc) <- smoke_cdf[, 1]
barplot(sort(smoker_perc), main = "Smoker Population in USA by State",
        cex.names = 0.6, las = 2, ylab = "percentage of smokers",
        col=c(rgb(255,20,147, maxColorValue = 255),
              rgb(30,144,254, maxColorValue = 255),
              rgb(254,215,0, maxColorValue = 255),
              rgb(0,254,0, maxColorValue = 255)))
```



In the graph of “Lung Cancer Patients in USA by State”, we ordered the percentage of lung cancer patients in ascending order by states. It shows that Kentucky has the highest lung cancer rate while Utah has the lowest lung cancer rate.

```
lung_cancer_perc <- smoke_cancer_cdf$cancer...
names(lung_cancer_perc) <- smoke_cdf[, 1]
barplot(sort(lung_cancer_perc),
        main = "Lung Cancer Patients in USA by State",
        cex.names = 0.6, las = 2, ylab = "percentage of lung cancer patients",
        col=c(rgb(255,255,200, maxColorValue = 255),
              rgb(221,160, 221, maxColorValue = 255),
              rgb(255,250,205, maxColorValue = 255),
              rgb(230,230,250, maxColorValue = 255)))
```

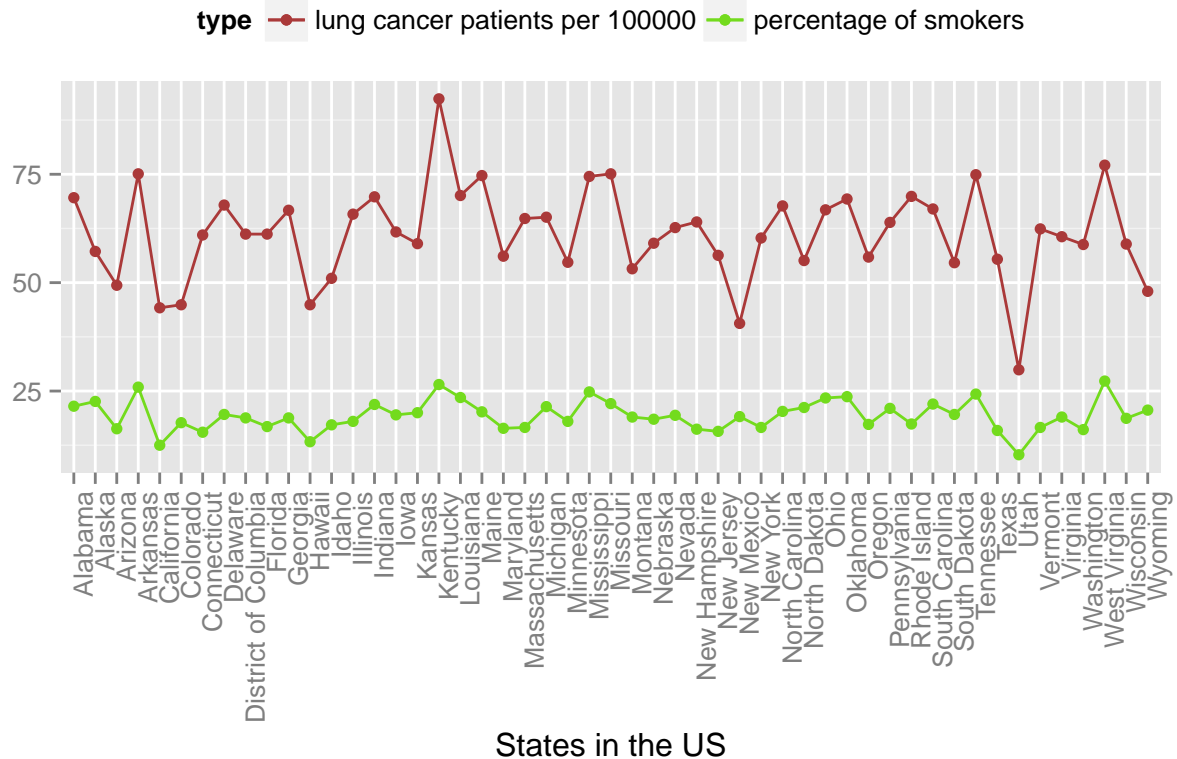
Lung Cancer Patients in USA by State



In this graph, we compared the rate of smoking population of each state with the rate of lung cancer patients. It shows that the higher smoking population in the state lead to a greater number of lung cancer patients.

```
ggplot(smoke_cancer_cdf) +
  geom_point(aes(x = names(smoker_perc),
                y = smoke_cancer_cdf$smokers..., col = "red")) +
  geom_line(aes(x = names(smoker_perc),
                y = smoke_cancer_cdf$smokers..., col = "red", group = 1)) +
  geom_point(aes(x = names(smoker_perc),
                y = smoke_cancer_cdf$cancer... * 1000, col = "green")) +
  geom_line(aes(x = names(smoker_perc),
                y = smoke_cancer_cdf$cancer... * 1000, col = "green", group = 2)) +
  theme(axis.text.x = element_text(angle = 90, hjust = 1)) +
  scale_color_manual(values = c("#AA3939", "#73DB1D"), name = "type",
                    labels = c("lung cancer patients per 100000",
                              "percentage of smokers")) +
```

```
theme(legend.position = "top") +
xlab("States in the US") +
ylab("")
```

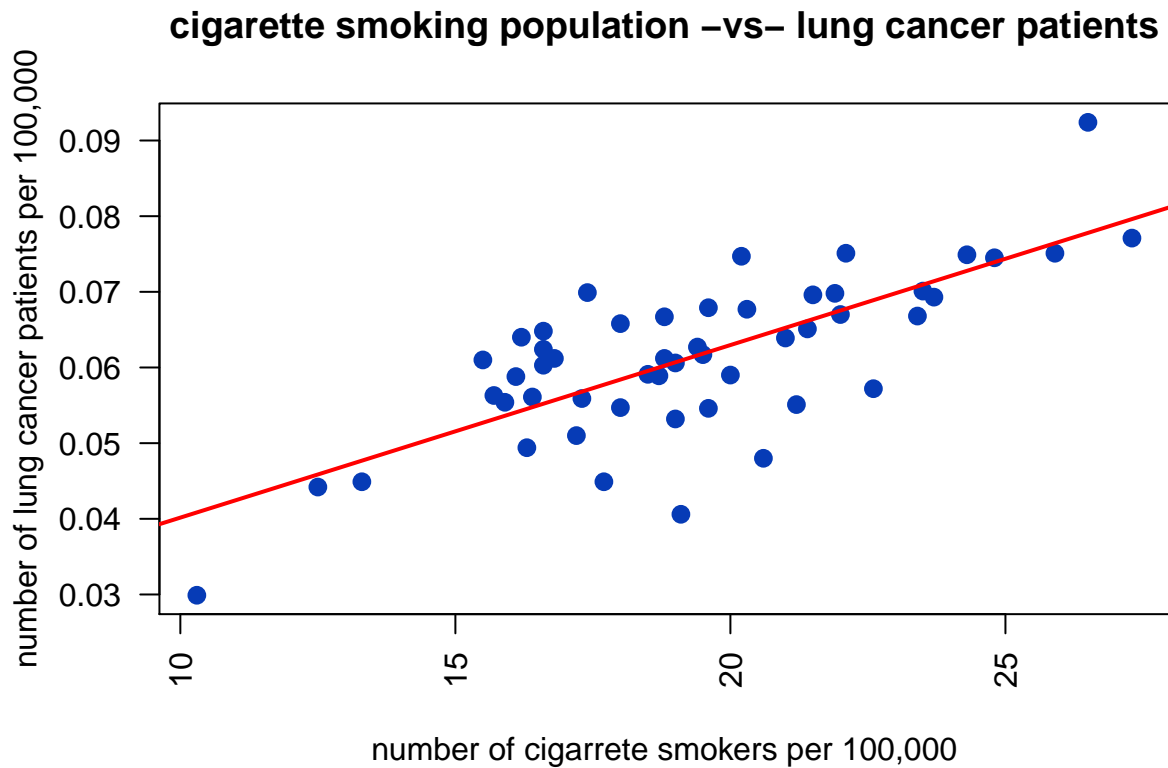


In this linear regression model, we analyzed the correlation between the rate of smoking population with the number of lung cancer patients. It clearly show that there is a positive correction between the two factors.

```
smoke_cancer_fit <- lm(smoke_cancer_cdf$cancer... ~ smoke_cancer_cdf$smokers...)
smoke_cancer_fit
```

```
##
## Call:
## lm(formula = smoke_cancer_cdf$cancer... ~ smoke_cancer_cdf$smokers...)
##
## Coefficients:
##              (Intercept)  smoke_cancer_cdf$smokers...
##              0.017352              0.002281
```

```
plot(smoke_cancer_cdf$smokers..., smoke_cancer_cdf$cancer...,
     pch = 16, cex = 1.3, col = "#063BB6",
     main = "cigarette smoking population -vs- lung cancer patients", las = 2,
     xlab = "number of cigarette smokers per 100,000",
     ylab = "number of lung cancer patients per 100,000")
abline(smoke_cancer_fit, col = "#FF0000", lwd = 2)
```



Downloading male and female lung cancer raw data

```
download.file(url = "https://raw.githubusercontent.com/leanne8/smoke_and_die/master/rawdata/lung_cancer_male.csv",
              destfile = "../rawdata/lung_cancer_male.csv")

download.file(url = "https://raw.githubusercontent.com/leanne8/smoke_and_die/master/rawdata/lung_cancer_female.csv",
              destfile = "../rawdata/lung_cancer_female.csv")
```

Data Cleaning and Preparation for lung cancer data

```
male_df <- read.csv("../rawdata/lung_cancer_male.csv", header = TRUE,
                    sep = "\t", col.names = c("X", "male_age", "male_all",
                                                "white", "black", "asian",
                                                "native_american", "hispanic"),
                    stringsAsFactors = FALSE)
male_df[, 1] <- NULL

female_df <- read.csv("../rawdata/lung_cancer_female.csv", header = TRUE,
                      sep = "\t", col.names = c("X", "female_age",
                                                  "female_all", "white", "black",
                                                  "asian", "native_american",
                                                  "hispanic"),
```

```

stringsAsFactors = FALSE)
female_df[ , 1] <- NULL

male_df[male_df == "~"] <- NA
female_df[female_df == "~"] <- NA

for (i in 2:length(colnames(male_df))) {
  male_df[ , i] <- as.numeric(male_df[ , i])
  female_df[ , i] <- as.numeric(female_df[ , i])
}

write.table(male_df, file = "../data/male_cdf.csv",
            row.names = FALSE, col.names = TRUE, sep = ",")
write.table(female_df, file = "../data/female_cdf.csv",
            row.names = FALSE, col.names = TRUE, sep = ",")

```

Data preparation for plotting lung cancer rate vs race

```

male_cdf <- read.csv(file = "../data/male_cdf.csv",
                    header = TRUE, stringsAsFactors = FALSE)
female_cdf <- read.csv(file = "../data/female_cdf.csv",
                      header = TRUE, stringsAsFactors = FALSE)

male_fifty_df <- male_cdf[12:19, ]

total_rate_male <- c()
for (i in 1:5){
  total_rate_male[i] <- round(sum(male_fifty_df[ , (i+2)]) / 8, digit = 1)
}
names(total_rate_male) <- colnames(male_fifty_df)[3:7]

female_fortyfive_df <- female_cdf[11:19, ]

total_rate_female <- c()
for (i in 1:5) {
  total_rate_female[i] <- round(sum(female_fortyfive_df[ , (i+2)]) / 9, digit = 1)
}
names(total_rate_female) <- colnames(female_fortyfive_df)[3:7]

```

Visualization Part 2

In this bar chart, it illustrates that the rate of lung cancer patients by race. It shows that black male and white female have higher chances of getting lung cancer.

```

total_rate_combined <- cbind("Male" = total_rate_male,
                             "Female" = total_rate_female)

barplot(total_rate_combined,
        col = c("#FFFFFF", "#000000", "#984126", "#FFFF00", "#E5A470"),
        main = "Lung Cancer Patients by Race",
        ylab = "frequency per 100,000", beside = TRUE)
legend("topright",
      title = "Race",

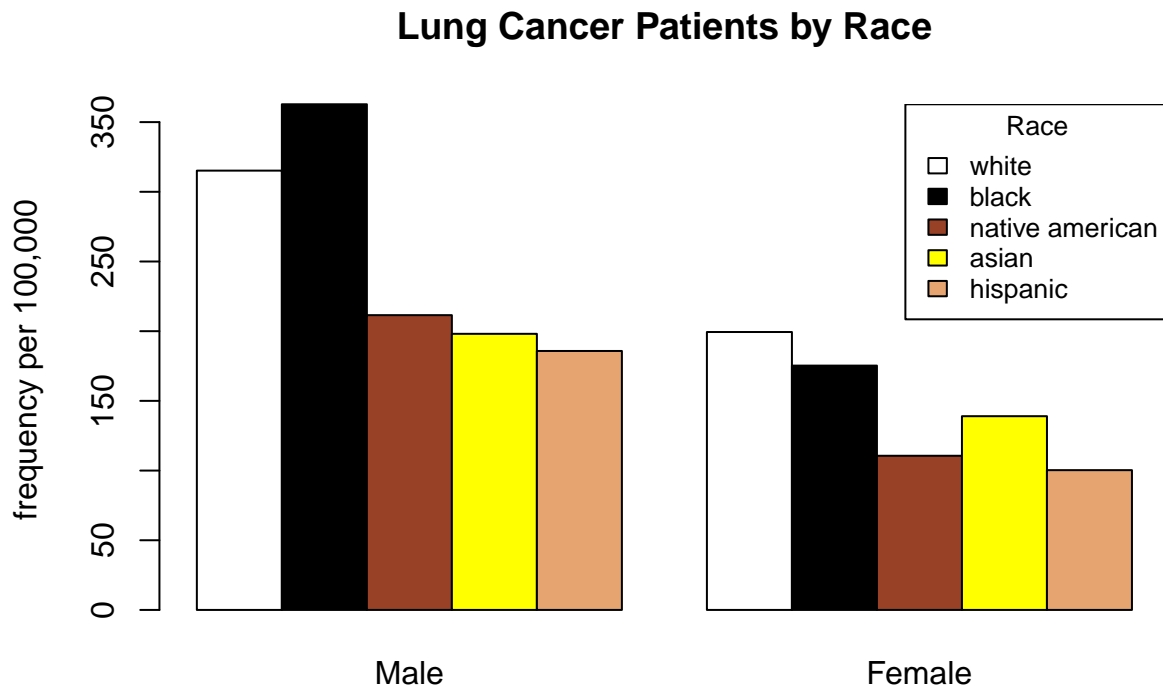
```



```

legend = c("white", "black", "native american", "asian", "hispanic"),
fill = c("#FFFFFF", "#000000", "#984126", "#FFFF00", "#E5A470"),
cex = 0.8)

```

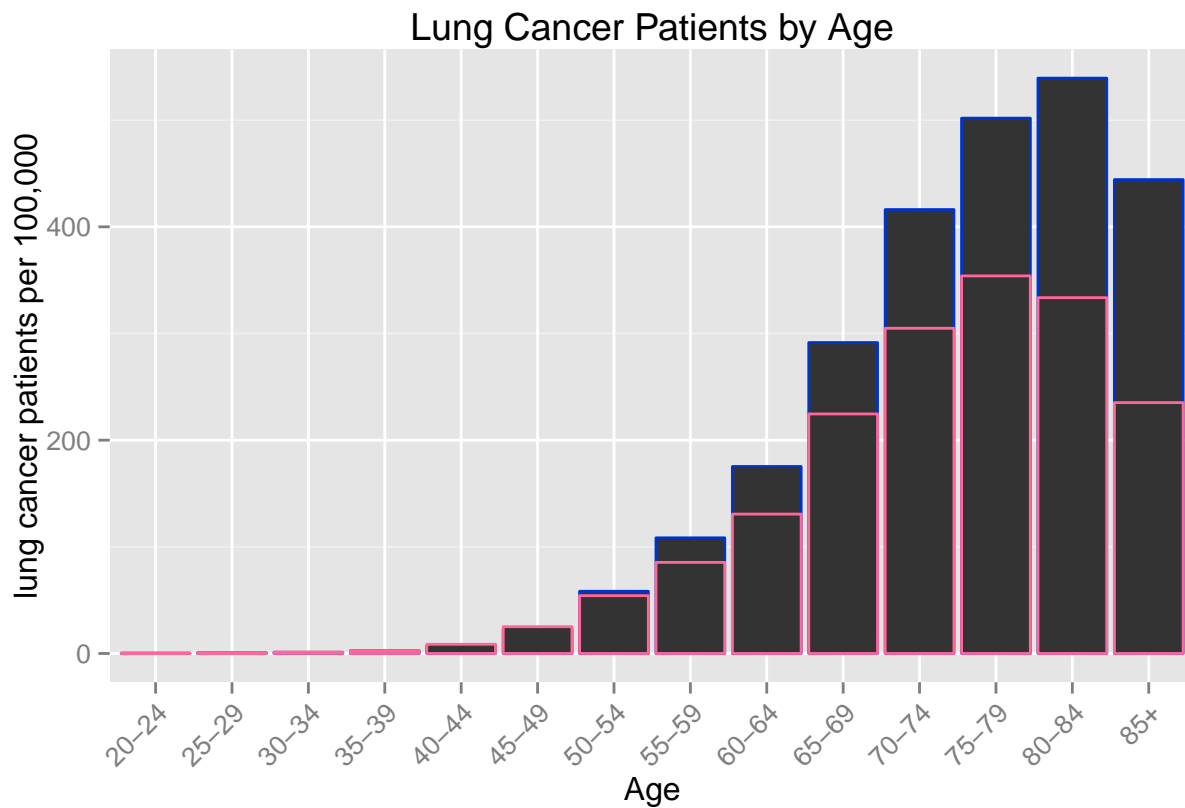


In this bar chart, it shows relationship between the rate of lung cancer patients by different age groups. The graph not only shows that older people have higher chance of being diagnosed with lung cancer, but also males have higher chance of getting lung cancer than females do.

```

both_gender_df <- cbind(male_cdf, female_cdf)
both_gender_df <- both_gender_df[,-c(1:5), ]
ggplot(both_gender_df) +
  geom_bar(aes(x = both_gender_df$male_age, y = both_gender_df$male_all),
    stat = "identity", col= "#0033CC") +
  geom_bar(aes(x = both_gender_df$female_age, y = both_gender_df$female_all),
    stat = "identity", col= "#FF6699") +
  theme(axis.text.x = element_text(angle = 45, hjust = 1)) +
  xlab("Age") + ylab("lung cancer patients per 100,000") +
  ggtitle("Lung Cancer Patients by Age")

```



Exporting plots as png files

```
png(filename = "../images/smokepop.png")
barplot(sort(smoker_perc), main = "Smoker Population in USA by State",
        cex.names = 0.6, las = 2, ylab = "percentage of smokers",
        col=c(rgb(255,20,147, maxColorValue = 255),
              rgb(30,144,254, maxColorValue = 255),
              rgb(254,215,0, maxColorValue = 255),
              rgb(0,254,0, maxColorValue = 255)))
dev.off()
```

```
## pdf
## 2
```

```
png(filename = "../images/lungcancer.png")
barplot(sort(lung_cancer_perc),
        main = "Lung Cancer Patients in USA by State",
        cex.names = 0.6, las = 2, ylab = "percentage of lung cancer patients",
        col=c(rgb(255,255,200, maxColorValue = 255),
              rgb(221,160, 221, maxColorValue = 255),
              rgb(255,250,205, maxColorValue = 255),
              rgb(230,230,250, maxColorValue = 255)))
dev.off()
```

```
## pdf
## 2
```

```
png(filename = "../images/comp.png")
figure1 <- ggplot(smoke_cancer_cdf) +
  geom_point(aes(x = names(smoker_perc),
                 y = smoke_cancer_cdf$smokers..., col = "red")) +
  geom_line(aes(x = names(smoker_perc),
                 y = smoke_cancer_cdf$smokers..., col = "red", group = 1)) +
  geom_point(aes(x = names(smoker_perc),
                 y = smoke_cancer_cdf$cancer... * 1000, col = "green")) +
  geom_line(aes(x = names(smoker_perc),
                 y = smoke_cancer_cdf$cancer... * 1000, col = "green", group = 2)) +
  theme(axis.text.x = element_text(angle = 90, hjust = 1)) +
  scale_color_manual(values = c("#AA3939", "#73DB1D"), name = "type",
                     labels = c("lung cancer patients per 100000",
                                "percentage of smokers")) +
  theme(legend.position = "top") +
  xlab("States in the US") +
  ylab("")
plot(figure1)
dev.off()
```

```
## pdf
## 2
```

```
png(filename = "../images/reg.png")
plot(smoke_cancer_cdf$smokers..., smoke_cancer_cdf$cancer...,
     pch = 16, cex = 1.3, col = "#063BB6",
     main = "cigarette smoking population -vs- lung cancer patients", las = 2,
     xlab = "number of cigarette smokers per 100,000",
     ylab = "number of lung cancer patients per 100,000") +
  abline(smoke_cancer_fit, col = "#FF0000", lwd = 2)
```

```
## numeric(0)
```

```
dev.off()
```

```
## pdf
## 2
```

```
png(filename = "../images/race.png")
barplot(total_rate_combined, col = c("#FFFFFF", "#000000", "#984126", "#FFFF00",
                                     "#E5A470"),
        main = "Lung Cancer Patients by Race",
        ylab = "frequency per 100,000", beside = TRUE)
legend("topright",
       title = "Race",
       legend = c("white", "black", "native american", "asian", "hispanic"),
       fill = c("#FFFFFF", "#000000", "#984126", "#FFFF00", "#E5A470"),
       cex = 0.8)
dev.off()
```

```
## pdf
## 2
```

```
png(filename = "../images/age.png")
figure2 <- ggplot (both_gender_df) +
  geom_bar(aes(x = both_gender_df$male_age, y = both_gender_df$male_all),
    stat = "identity", col= "#0033CC") +
  geom_bar(aes(x = both_gender_df$female_age, y = both_gender_df$female_all),
    stat = "identity", col= "#FF6699") +
  theme(axis.text.x = element_text(angle = 45, hjust = 1)) +
  xlab("Age") + ylab("lung cancer patients per 100,000") +
  ggtitle("Lung Cancer Patients by Age")
plot(figure2)
dev.off()
```

```
## pdf
## 2
```